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EDITOR
JAMES YOUNG

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All Business Correspondence to
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All Editorial Correspondence to
Prof. James Young
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THE PITOCIN DRIP

BY

G. W. THEOBALD, M.A., M.D., F.R.C.S., M.R.C.P., F.R.C.O.G.

H. A. KELSEY, M.B., M.R.C.O.G.

AND

J. M. B. MUIRHEAD, M.B., D.Obst.R.C.O.G.

From St. Luke's Maternity Hospital, Bradford

WORLD-WIDE interest has been aroused in the use of the oxytocin intravenous drip in obstetrics since it was first advocated from this hospital in 1948 by Theobald, Graham, Campbell, Gange and Driscoll. Two years later papers on the oxytocin drip were published by Hellman, Harris and Reynolds (1950), Stone (1950) and Reynolds, Heard, Bruns and Hellman (1948). Since then numerous communications have been published from all over the world and this procedure is now included in the standard obstetric books. Hellman did mention in 1949 that he had tried the continuous intravenous use of oxytocin, but the title of the paper in which he published his observations is the best evidence that he was not at that time very much impressed with the method. It must also be mentioned that Page (1943) in a short note on "Response of human pregnant uterus to pitocin tannate in oil" observed that "the most physiological responses in severe primary uterine inertia have actually been obtained by giving an intravenous infusion of normal saline containing either 10 or 20 units of pitocin to the liter . . . This latter technique deserves further trial in selected cases of marked uterine inertia." There is no evidence that such trial was ever made.

The following points emerge from a careful perusal of the literature on the pitocin drip:

(1) The danger of rupture of the uterus (Ferguson, Schneider and Miller, 1952), and even of maternal death (Mauzy, 1954; Lesser and Eason, 1954).
(2) The danger and uselessness of employing it in cases of hypertonic or inco-ordinate uterine action (Jeffcoate, Baker and Martin, 1952; Jeffcoate, 1952). Jeffcoate thinks the pitocin drip is only of value in treating "lazy or weak" uterine action, which is "relatively uncommon".
(3) The undesirability of using it in patients who have had a previous Caesarean section or in women "having their sixth or subsequent baby" (Llewellyn-Jones, 1955).
(4) "In the presence of disproportion, a malpresentation, excessive parity, a hypertonic uterus, the use of an oxytocin is absolutely contraindicated" (Nixon, 1952). All authors are agreed that the presenting part must be engaged by its greatest diameter and that no abnormality of labour should be present, if the pitocin drip is to be used.
(5) Nearly all authors postulate that an experienced obstetrician should remain beside the patient during the whole of the time that the drip is running (Greenhill, 1955), while many believe that some form of tocodynamometer should invariably be used to measure the uterine response, and prefer the treatment to be carried out in an isolated ward.

Such limitations would markedly lessen the usefulness of the drip and it seems to us that the fundamental concept of the use of oxytocin

"in physiological amounts", as postulated by Theobald *et al.* (1948), has been almost entirely overlooked. Practically all those interested in the drip have been content to use oxytocin as a pharmacological substance in weak dilution. If it be true that nature has designed oxytocin as the hormone to initiate labour and to effect delivery, it is evident that it is logical to use it by the drip method in any case in which the obstetrician deems labour justifiable. It would, moreover, follow that inco-ordinate uterine action must be due to activity superimposed on the normal contractions, and the task of the obstetrician is to eliminate extraneous stimuli, not to withhold oxytocin.

Is Oxytocin a Hormone or an Extract?

Theobald (1936) postulated that there was a centre, or centres, in the hypothalamus which controlled menstruation, ovulation, pregnancy and parturition. He drew attention to the "two cell masses, named the paraventricularis and the supra-opticus", from which "nerve fibres pass into the pituitary stalk". Both cell masses "receive a very rich systemic blood supply . . . and are freely bathed with blood returning from the pituitary sinusoids". He based this postulate in part on clinical observations and in part on the results of water diuresis experiments.

He (Theobald, 1934a, b) showed that the intravenous injection of from 0·0005 to 0·01 unit of "infundin" inhibited water diuresis not only in the dog but also in man, and in women during the last weeks of pregnancy. The amount of antidiuretic activity (ADH) necessary to inhibit water diuresis was remarkably constant for each dog, and the curves showing water diuresis thus inhibited by a given amount of infundin, obtained over a period of several months, could be almost superimposed. The remarkable thing was that infundin, a post-pituitary extract prepared by Messrs. Burroughs Wellcome and Co., was standardized for its oxytocic content. It therefore occurred to him that a concentration of oxytocin, similar to that of ADH which inhibited water diuresis, might stimulate uterine contractions in a woman at term.

Although Newton concluded in 1937 that oxytocin was to be regarded as an extract and not a hormone, much work has since been done to cause a revision of this view.

Effects on Parturition Caused by Damage to the Pituitary Gland

Fisher, Ingram and Ranson (1938) demonstrated that the hypothalamus influences the secretion of the post-pituitary gland by means of the supra-optico-hypophyseal tract. In the same year Fisher, Magoun and Ranson reported that they had provoked diabetes insipidus in 85 cats by interrupting these tracts. In seven cats the operation was carried out during pregnancy. "They were totally or partially unable to deliver their young or else succeeded in doing this only after a greatly prolonged labour which lasted in some cases over two days." Of these 7 cats, 4 died in labour, 2 survived for a few days, and only one remained alive and well.

Pencharz and Long (1933) performed hypophysectomy in 28 pregnant rats. When the operation was performed on the 4th day of pregnancy, implantation failed to occur; between the 7th and 10th day, resorption occurred within 24 to 72 days of the operation; "Ablation of the hypophysis between days 11 and 20 of pregnancy is followed by death of the mother at the end of a prolonged period of gestation or the birth of dead and living young after a similarly prolonged period of pregnancy. Removal of the hypophysis on day 21, however, is followed by normal parturition at term." Whereas their results are comparable with those of Fisher, Ingram and Ranson (1938), they attributed the abnormal uterine activity to insufficiency of anterior pituitary tissue.

Dey, Fisher and Ranson (1941), working with female guinea pigs, inflicted medially placed lesions in the hypothalamus which reached the ventral surface of the brain at the level of, and just behind the optic chiasma. Most of these animals remained sterile and slightly less than one-third of those which did become pregnant delivered normally. About half of them had definitely prolonged or delayed labour, or delivered dead foetuses. Six of them, in which the lesions had been caused before pregnancy, died in convulsions during late pregnancy.

It is of interest to note that Smith, who in 1932 wrote of "The non-essentiality of the

posterior hypophysis in parturition", reported in 1946 that, in 6 rhesus monkeys which were hypophysectomized during pregnancy, labour was prolonged in every case and that Caesarean section became necessary to deliver 3 of them.

Labour Associated with Diabetes Insipidus

Marañón (1947) described the association of uterine atony with diabetes insipidus. He first saw the patient when she was 17 years old. She then suffered from attacks of headache, scintillating scotomata, spasticity, and paraesthesiae localized to the limbs of the left side. The first pregnancy occurred 12 years later. Labour seemed to commence on several occasions, but the pains soon stopped. After 5 days without recognizable labour pains she was delivered of a full-time stillborn foetus. The daily polyuria of 20 litres which persisted during pregnancy, dropped to 7 litres after her confinement. Three years later a successful delivery was accomplished with the aid of pituitrin injections. Owing to the Spanish Civil War the third full-time confinement could not be so aided, and after 3 days of fruitless labour a dead foetus was extracted.

The Effect of Suckling on the Uterus and on Water Diuresis

It has been known for centuries that after pains are often provoked or augmented by the act of suckling. As early as 1910, Ott and Scott found that the flow of milk in a goat could be caused within about a minute by the intravenous injection of infundibulin, and Ely and Peterson (1941) subsequently postulated the neurohormonal concept of "let-down" of milk. It has since been established that the act of suckling causes antidiuresis in rabbits, dogs, cows, and in man (Cross, 1951; Kalliala, Karvonen and Leppänen, 1952; Peeters, Coussens, Bouckaert and Oyaert, 1949; Kalliala and Karvonen, 1951).

Effects Caused by Direct or Indirect Stimulation of the Pituitary Gland

Haterius 1940) showed that electrical stimulation of the pituitary stalk inhibited diuresis in anaesthetized rabbits, and Haterius and Ferguson (1938) that similar stimulation caused increased uterine activity in post-partum animals. Ferguson (1947), working with post-partum rabbits and cats, obtained similar results. Harris (1947, 1948) was the first to record both activities at the same time. Working with conscious rabbits he showed that remote control stimulation of the supra-optico-hypophyseal tract, or the neurohypophysis, caused simultaneous inhibition of diuresis, increased uterine activity, and intestinal peristalsis.

Abrahams and Pickford (1954) used conscious dogs, each provided with a fistula of the uterine horn and a carotid loop. They found that "Stimuli such as emotion, the intracarotid or intravenous injection of hypertonic NaCl solutions, or of acetylcholine, and intravenous sucrose solutions, all of which inhibit water diuresis by liberation of posterior lobe antidiuretic hormone, also caused increased uterine activity which was co-terminous with the antidiuresis". They believed that the effects on the uterus were due to the liberation of the post-pituitary oxytocic factor.

The Excretion of Urine During Labour

The intravenous injection of 0·5 mU of ADH a minute almost invariably suffices to cause partial inhibition of water diuresis in both males and females and in women during pregnancy, and it is very remarkable that the same amount of oxytocin sometimes suffices to provoke and to stimulate the pains of labour. The excretion of urine during labour may consequently shed indirect light on the problem as to whether oxytocin can be released independently of ADH.

It is well known that the amount of urine excreted during the course of labour varies within wide limits. Seeing that the pain associated with the contractions, the anxiety inseparable from the process, and the muscular work involved, are in themselves capable of provoking release of ADH, it is surprising that so many women secrete urine freely throughout the course of labour. A primigravida, aged 39, with hypertension, passed 48 ounces (1·4 litres) of urine during the hour preceding her delivery, and 55 ounces (1·6 litres) in the succeeding hour, during which she had a fit. More recently a primigravida, aet. 18, was admitted late at night with her cervix half dilated after 12 hours in labour. She was given morphine gr. ¼ (16 mg.)

and scopolamine gr. 1/100 (0·65 mg.), and an infant weighing 7 pounds 8 ounces (3·3 kg.) was delivered 6 hours later. In spite of the fact that her blood pressure rose to 160/100 mm. Hg, and protein was found in her urine, she secreted 24 ounces (842 ml.) of urine during the 6 hours immediately preceding delivery. In addition to this amount, which was removed through a catheter, she passed some in her bed. No fluid was administered intravenously, and patients do not drink very freely during the middle of the night, particularly when they are under the influence of morphia.

It is nevertheless true that the fluid intake during the course of labour, particularly when it is prolonged for more than 12 hours, usually exceeds the urine output.

On a few occasions water diuresis experiments were carried out during the course of early labour induced by the pituitrin drip, and in some patients simultaneous kymographic recordings of the uterine contractions were obtained by means of polythene tubing introduced into the amniotic cavity, by the method described by Williams and Stallworthy (1952). One of these primigravidae, who was delivered of a 9½ pound (4·3 kg.) infant some 14 hours later, passed 339 ml. of urine in 2½ hours, having drunk 1 litre of water and received intravenously during that time 128 ml. of a 1:10,000 solution of pituitrin (128 mU of both oxytocin and ADH).

Generally speaking the woman excreted during the course of the investigation approximately a third of the fluid administered, providing the concentration of pituitrin did not exceed 1:25,000, given at the rate of 40 drops a minute. As this concentration was increased the difference between the pitocin and the pituitrin drip on the rate of urine secretion became increasingly evident.

The Pitocin Drip

We have used the pitocin drip in Bradford on well over a thousand occasions, for the purpose both of inducing labour and of treating uterine inertia. The registrars decide on its use according to general instructions and direct the house surgeons to set it up. No special precautions are taken beyond seeing that the primary drip does not exceed a concentration of 1:5,000, and that no untoward alterations in the rhythm or rate of the foetal heart occur during the first half hour that the drip is running. The patient is left in her own bed and on occasions three or more drips may be running in one ward. It will subsequently be shown that the drip has been freely used in cases of contracted pelvis when the head is not engaged, in cases of placenta praevia, accidental haemorrhage, and triplets; in grande multiparae who have given birth to 13 or more children, and in patients who have previously been delivered by Caesarean section. On no occasion, over a period of 8 years, has the oxytocin drip caused any anxiety concerning the mother, and but rarely has it had to be stopped because it caused irregularity of the foetal heart.

In this paper we propose to describe the results obtained from the following threefold procedure, first developed towards the end of 1952.

(1) We are convinced that intact membranes during labour are a liability rather than an asset. When inducing labour the membranes are first swept as widely as possible and are then punctured at the lowest possible point. The hole in the membranes is enlarged and as much liquor amnii as possible is allowed to escape. We believe that every woman, be she primigravida or multigravida, should be nearing delivery after she has been in labour for 12 hours. If at the end of that time labour is not progressing favourably the membranes are swept and ruptured.

(2) Once labour is established we use morphine gr. ¼ (16 mg.) and scopolamine gr. 1/100 (0·65 mg.) freely, and add 200 mg. of pethidine to the drip bottle. In cases of inertia the drip is not set up until the patient is well under the influence of the morphia and scopolamine. We use in addition the barbiturates and largactil without stint. We have the greater confidence in using morphia at any time in labour because the injection of 10 mg. of lethedrone into the mother shortly before delivery, or the injection of 0·5 to 1 mg. into the infant, overcomes the depressant effect of the drug.

(3) Approximately 80 per cent of patients go into labour within 24 hours of the rupture of their membranes. If on the morning of the day following this procedure the patient is not in labour a 1:5,000 pitocin (a commercial prepara-

tion of oxytocin prepared by Messrs. Parke, Davis & Co.) drip is set up. If labour commences the drip is kept running until the placenta is delivered, for it prevents post-partum haemorrhage. If the 1:5,000 drip does not cause the onset of labour a 1:2,500 solution is used in the second bottle. If this proves ineffective the drip is taken down and recommenced the next day. Ineffectiveness of the drip merely demonstrates that the uterine muscle has not become sensitized to oxytocin.

Approximately 66 per cent of cases of uterine inertia go into strong labour after the membranes are swept and ruptured, and in the remaining cases a pitocin drip is employed, after the patient has been put under the influence of morphia.

It will be recognized that these three procedures are dependent the one on the other. No obstetrician would sweep and rupture the membranes of approximately 600 patients in a year, neither could he use morphine and other depressant drugs so freely, if he could not rely on the pitocin drip. Neither would the drip prove so effective if the membranes were not previously ruptured. The most important fact we have learned is that the best results are obtained when the drip is used early in labour and not after the patient has suffered ineffective pains for more than 48 hours.

It is freely admitted that the drip is often used unnecessarily, in the sense that the patients would have delivered themselves without it. Nearly all patients will ultimately go into labour spontaneously and deliver themselves, often after over a hundred hours in labour. The value of this triple procedure must be judged by the impact it makes on the method of delivery and the foetal wastage, for there was no maternal mortality. Before discussing the results obtained, brief accounts will be given of the method of rupturing the membranes and that of setting up the pitocin drip.

The Injection of Hyaluronidase and Procaine in the Treatment of the Unripe Cervix

It is sometimes desirable to terminate labour in a patient whose cervix is long and hard and barely admits one finger. In some centres dilators are used to dilate the cervix, but this procedure does not appeal to us.

Some years ago one of us (G.W.T.) injected procaine into the cervix with the object both of inducing and of relieving the pain of labour. He recently learned from Professor Antoine, of Vienna, that he had found the injection of hyaluronidase was sometimes valuable in causing the cervix to become ripe, but he did not know who had originated the idea.

We have injected 1,000 units of hyalase (a preparation of hyaluronidase made by Benger Laboratories) in 40 ml. of 1 per cent procaine well into the rigid cervix, and particularly in the neighbourhood of the internal os uteri, and given a drip containing quinine gr. 2 (64 mg.) in 500 ml. of glucose solution, or a 1:5,000 solution of pitocin. This treatment has been tried on some 40 occasions and in just over half of them the cervix became ripe and permitted sweeping and rupture of the membranes within 48 hours. Unless the time factor is important it is desirable to wait 3 or 4 days after the cervix has been taken up before rupturing the membranes, as it is sometimes difficult to induce labour in such patients.

The Sweeping and Rupture of the Membranes

The cervix must be soft and taken up and admit at least one finger easily. In a multigravida who has borne a child recently it is almost always safe to rupture the membranes, under general anaesthesia if necessary, but a multigravida who has not given birth to a child for over 10 years must be regarded as a primigravida. Oleum ricini, 2 ounces, followed by an enema some 4 hours later, is given just before or subsequent to the artificial rupture of the membranes (ARM).

The Actual Procedure

Rupture of the membranes is regarded as a very important, and by no means simple procedure and is invariably carried out, either by a consultant or a registrar, in the obstetric theatre and not in a labour ward. The patient is placed in the Trendelenburg position. Under the most scrupulous antiseptic and aseptic precautions, the patient being under self-induced trilene analgesia, the membranes are thoroughly swept, and then ruptured by scratching with an ordinary catheter stilette. The small hole in the amniotic sac is enlarged and as much liquor amnii as possible is allowed to escape. The whole pro-

cedure may take more than 5 minutes. The finger or fingers in the cervix can completely control the rate of escape of liquor amnii, and once introduced they should not be removed until the operation is complete. The operator must be satisfied (1) that the maximum possible amount of liquor amnii has escaped, and (2) that the presenting part is so gripped by the lower segment that it is impossible for the cord or a limb to prolapse. If necessary, 2 units of pitocin may be given intramuscularly to make sure that the presenting part is safely housed. Failure in inducing labour is often, as in some of the cases to be reported, due to unsatisfactory rupture of the membranes. They may be punctured and a considerable amount of liquor amnii may escape, but the hole in the membranes may become sealed. It is not usually advisable to set up the pitocin drip until at least 12 hours have elapsed from the time that the membranes were ruptured.

Penicillin and Vitamin K

Eight-hourly intramuscular injections of 500,000 units of penicillin are given to each patient from the time the membranes are ruptured until delivery is completed, and 10 mg. of vitamin K are given orally at the same time intervals. These precautions are taken largely in the interest of the infant, but it may be observed that over a period of 3 years only 3 out of approximately 1,800 women, who were subjected to the above procedure, developed pyrexia during labour, and in 1 case it was definitely due to an infection of the urinary tract.

Setting Up the Drip

A sterile trolley is prepared containing (*a*) pitocin ampoules (together with a file) in spirit, (*b*) 2 gallipots, (*c*) a 1 ml. tuberculin syringe, (*d*) a 5 ml. syringe, (*e*) some needles, one large and long, several small hypodermic needles, size 18, and one size 2, together with an adaptor. A giving set, and two or three bottles of 5 per cent glucose solution in water are kept in readiness.

Nine millilitres of the glucose solution are transferred into one gallipot, and 19 ml. into the other. Using the tuberculin syringe and a fine needle, 1 ml. of pitocin is added to each gallipot, making solutions of 1:10 and 1:20 respectively. One millilitre of the 1:20 dilution added to the glucose bottle gives a 1:10,000 solution. Each millilitre of this solution delivers 1 milliunit (1 mU) of pitocin. One millilitre of the 1:10 dilution similarly added gives a 1:5,000 solution. Each millilitre of the 1:10 dilution similarly added gives a 1:5,000 solution, each ml. delivering 2 mU. Two millilitres of the 1:10 dilution similarly added gives a 1:2,500 solution, each ml. delivering 4 mU.

The standard rate of running the drip is 40 drops a minute (d/m), so that the three solutions thus used deliver 2·5, 5, and 10 mU per minute, respectively.

Each bottle is labelled immediately, the label being affixed upside down, so that the dilution can be more easily read when the bottle is in use.

It must be stated that the drip bottle contains approximately 540 ml., and that there is inevitably some variation in the rate at which the fluid enters the vein.

The Use of the Pitocin Drip in Toxaemic Patients

The pitocin drip has been used when necessary in cases of eclampsia and pre-eclampsia. Where marked oedema is present the delivery of excessive fluid through the vein is dangerous. It may be desirable to use a 1:2,500 dilution and limit the rate of flow to between 10 and 20 drops a minute, and the duration of the drip to a few hours.

The Use of the Pitocin Drip in Patients with Heart Disease

Most "heart" cases have short labours. During the years 1952–55 inclusive, 121 cases of heart disease were delivered in the hospital, 43 being primigravidae and 78 multigravidae. The average duration of labour for the primigravidae was 12·5 hours, and for the multigravidae, 4·9 hours. The pitocin drip was given to 4 primigravidae and 5 multigravidae. As in toxaemic women the dominant factor is that of water retention, and the same considerations apply.

The Method of Delivering the Drip

In 1948 we tried giving the pitocin drip subcutaneously and employed hyaluronidase to aid in its absorption. For a considerable time we introduced polythene tubing into the vein, but are now satisfied that the best method of delivering the drip is through a hypodermic needle introduced into a small vein on the

forearm. We tried using very small needles but it was difficult to prevent them from moving about and piercing the wall of the vein. This difficulty has been overcome by using a No. 2 hypodermic needle which necessitates the use of an adaptor to connect it with the giving set.

The rubber tubing is clamped, after fluid has been run through it, and the connexion is made with the clamp firmly closed. It is then slowly opened and the rate is gradually increased until it flows at the rate of 40 d/m. The house surgeon stays with the patient for a half an hour and satisfies himself that the drip causes no change in the rate, frequency, or force of the foetal heart. If the uterine contractions occur too frequently, or are prolonged, it is better to change at once to a 1:10,000 solution of pitocin rather than to slow the rate of the drip. If any anxiety is felt in any institution about the immediate danger of the drip, two giving sets can be used and the pitocin drip needle can be introduced into the rubber tubing of a glucose drip. The needle and tubing are strapped in position in the ordinary way and a forearm splint is applied. Once labour pains are established 200 mg. of pethidine are added to the glucose bottle. This not only tends to prevent abnormal uterine activity but relieves the pain of labour.

Acetylcholine

In the past we have added such substances as procaine, nicotine acid tartrate and quinine to the drip, but we have long since ceased to use them. In order to test the speculation that nerves supplying the fundus of the uterus might be cholinergic as opposed to the adrenergic fibres supplying the lower uterine segment, we administered a drip containing 5 g. of acetylcholine in 500 ml. of glucose solution through the tubing of the pitocin drip. The drip was run at the rate of from 16 to 40 d/m thus delivering from 10 to 25 mg. of acetylcholine each minute. In no case did any obvious improvement occur in the uterine contractions, but the substance tended to cause spasm of the vein into which it was introduced, tachycardia, and nausea. We desire to express our thanks to Messrs. Roche Products, Ltd., for so kindly giving us generous supplies of acetylcholine for this investigation.

Results Obtained During 1952, 1953 and 1954

The main indications for induction of labour in those patients who received a pitocin drip are shown in Table I. The indications for premature rupture of the membranes in the pitocin drip group were: rhesus antibodies, 19; anencephaly,

Table I

1952—1953—1954

Main Indications for Induction of Labour in Patients Who Subsequently had a Pitocin Drip

Indications	1952	1953	1944	Total
Unstable presentation / High head at term	5	10	12	27
Disproportion	3	2	5	10
Previous Caesarean section or difficult labour	2	5	0	7
"Toxaemia"	15	19	24	58
Postmaturity	9	18	20	47
Hydramnios	3	1	1	5
Antepartum haemorrhage	1	2	4	7
Totals	38	57	66	161

A considerable number of patients kept in the antenatal wards for one reason or another, usually hypertension, were induced at or about term, mainly because of shortage of antenatal beds.

7; accidental haemorrhage, 12; intra-uterine death of the foetus, 3; and "pre-eclampsia", 13, a total of 54. The results of induction of labour are shown in Table II, and the method of delivery of those who were given a pitocin drip is indicated in Table III. The gross foetal wastage associated with induction of labour and of premature labour is shown in Table IV, and it will be seen that, of the 108 stillbirths and infant deaths, 88 were unrelated to the induction or to the method of delivery. Of the remaining 20 deaths, a mortality of 1·9 per cent, 9 occurred in 1952, 6 in 1953, and 5 in 1954.

No cause could be found for 6 of the 9 avoidable foetal deaths which occurred in 1952, but in all 9 mothers a quinine induction of labour had been attempted. This foetal loss caused us with great reluctance to abandon the use of quinine in the induction of labour except for intra-uterine death of the foetus, when it is particularly successful.

Of the 11 avoidable stillbirths or infant deaths which occurred in the years 1952 and 1953, 4 were born to toxaemic mothers (3 with true pre-eclampsia), and two were associated with placenta praevia.

Avoidable Foetal Deaths Associated with the Use of the Pitocin Drip in the Induction of Labour

All these deaths, 7 in all, giving a gross

TABLE II

Results of Induction of Labour
1952—1953—1954
487 Primigravidae: 543 Multigravidae

Year	Inductions			Foetal Wastage		
	Total No.	No. not Requiring Drip	No. Requiring Drip	Total No.	Unavoidable	Avoidable
1952	306	255	51	40	31	9
1953	367	297	70	26	20	6
1954	357	256	101	42	37	5
Totals	1,030	808	222	108	88	20

The above numbers include those in whom labour was deliberately induced but not cases of placenta praevia and accidental haemorrhage, unless they subsequently had a pitocin drip.

TABLE III

Induction of Labour: Pitocin Drip. Method of Delivery

Years	Number of Patients	Spontaneous Delivery No. of Cases	Forceps Delivery No. of Cases	Breech Delivery No. of Cases	Caesarean Section No. of Cases
1952 ..	51 (1 twin pregnancy)	32	8	4	7
1953 ..	70 (1 twin pregnancy)	53	12 (1 twin pregnancy)	2	3
1954 ..	101	69	18	3	10
Totals ..	222 (2 twin pregnancies)	154	38 (1 twin pregnancy)	9	20

TABLE IV
1952—1953—1954
Gross Foetal Wastage Associated with Induction of Labour and Premature Labour

	1952	1953	1954	Totals
Number of Inductions	306	367	357	1,030
Total foetal deaths	40	26	42	108
Anencephaly	8	8	9	25
Hydrocephaly	1	0	3	4
Other malformations	2	0	0	2
Induced because of intra-uterine death of foetus ..	12	10	19	41
Kernicterus	2	0	0	2
Hydrops foetalis	4	1	1	6
Death during, or subsequent to, replacement transfusion	1	1	2	4
"Toxaemia"	1 (2 lb.) (0·9 kg.)	0	3 (1 lb. 6 oz.) (1 intestinal obstruction) (1 eclampsia)	4
Totals of deaths unrelated to induction	31	20	37	88

mortality of 3 per cent, have already been recorded in the previous section. Three were born to "toxaemic" mothers, and 1 was associated with placenta praevia. A stillbirth due to prolapse of the cord was extremely unfortunate, seeing that we advocate induction of labour to prevent this event. Of these foetal deaths, but 1 could be attributed to the pitocin drip and was born to the only patient of the pitocin series who was said to have had a contraction ring. She was a primigravida, aet. 34, and the infant weighing 6 pounds 6 ounces (2·9 kg.) was delivered by the breech. The pitocin drip was commenced at least 2 hours after the cervix had become fully dilated, and notwithstanding the fact that the foetal heart had been very irregular and at the time was varying in rate between 170 and 180 a minute. Further, an inviolate rule was broken and the drip was started at a 1:2,500 concentration of pitocin. When delivery was ultimately attempted difficulty was experienced in delivering the shoulders and head, and a "contraction" ring was felt. Delivery was nevertheless effected and, although the foetal heart was beating, respiration could not be established. It is doubtful if a true contraction ring was present, but it is certain that the drip should not have been employed.

UTERINE INERTIA

This group includes a number of differing types:

(1) The patient whose membranes rupture spontaneously and who goes into niggling labour which fails to progress satisfactorily.
(2) The patient admitted from outside who has been in labour for anything up to 96 hours.
(3) The patient whose pains give evidence of inco-ordination and are characterized by severe pain which contrasts markedly with the lack of progress in labour.
(4) The patient who demonstrates true secondary inertia.

Over 60 per cent of such patients proceeded

with satisfactory labour after their membranes had been swept and ruptured. The remainder, 216 during the three years 1952, 1953 and 1954, were given a pitocin drip (Table V).

It will be clearly seen from Table VI that the percentages of primigravidae who had spontaneous deliveries (whether following induction of labour or in association with uterine inertia), occurring in the different age groups, corresponded closely with the general hospital pattern of age distribution. In the forceps deliveries occurring in induced patients there is a definite shift to the right, markedly higher percentages occurring in the 21–25, and 26–30 age groups. This trend is still more evident in the forceps deliveries occurring in the inertia group, three times the expected percentage occurring in the 31–35 age group. Further, in those cases in which the forceps was applied through an incompletely dilated cervix, the average weight of the babies was 8 pounds (3·6 kg.), one pound (0·45 kg.) heavier than the hospital average weight for babies born to primigravidae. In this group, therefore, both the weight of the baby and the age of the mother were reflected in the mode of delivery.

TABLE V

1952—1953—1954

Uterine Inertia—Method of Delivery in Cases Receiving a Pitocin Drip

Years	No. of Spontaneous Deliveries	No. of Forceps Deliveries	No. of Breech Deliveries	No. of Caesarean Sections	Total Numbers
1952 ..	30 (1 twin pregnancy)	19 (1 twin pregnancy)	7	3	59
1953 ..	51 (1 case of triplets)	29	4	4	88
1954 ..	41	26 (1 twin pregnancy)	0	2	69
Totals ..	122	74	11	9	216

TABLE VI

The Pitocin Drip in Primigravidae

Table Showing the Percentages of Primigravidae Delivered in the Various Age Groups and the Influence of Age on the Mode of Delivery

Categories	15–20 Years	21–25 Years	26–30 Years	31–35 Years	36–40 Years	Over 41 Years
Hospital incidence	25	43	21	7	3·2	0·5
Induction of labour; spontaneous deliveries	22	43	19	10	3	2
Uterine inertia; spontaneous deliveries	25	40	21	9	4	0
Induction of labour; forceps deliveries	6	50	34	6	3	0
Uterine inertia; forceps deliveries	6	28	37	24	4	1
Uterine inertia; forceps deliveries (cervix not fully dilated) ..	13	33	33	13	7	0
Caesarean section	5	26	37	26	0	5

1952, 1953, 1954. Uterine Inertia: Pitocin Drip: 216 Cases, 221 Infants

Total foetal wastage, 21.

Unavoidable deaths, 15:

2 meningoceles.
1 hydrocephalus.
3 triplets (all under 2 pounds (0·9 kg.).
6 intra-uterine deaths (1 from accidental haemorrhage; 2 from prolapsed cord; not booked).
2 infant deaths (3 pounds 3 ounces (1·4 kg.); 3 pounds 14 ounces (1·7 kg.)).
1 infant death from peritonitis due to perforations in the small gut.

Avoidable deaths, 6:

1 stillborn infant delivered by the forceps, 7 pounds (3·2 kg.).
1 breech delivery, 9 pounds (4·1 kg.). The cord prolapsed during labour.
1 premature infant, 5 pounds 7 ounces (2·5 kg.). Spontaneous delivery, cerebral haemorrhage.
1 premature infant, 4 pounds 15 ounces (2·3 kg.). Forceps delivery, died of atelectasis.
1 infant, 6 pounds 14 ounces (3·1 kg.). Forceps delivery, bilateral tentorial tears.
1 infant, 6 pounds 4 ounces (2·8 kg.). Spontaneous delivery, died of atelectasis.

Total avoidable foetal mortality, 6 out of 206 or 3 per cent.

The Effect of the Pitocin Drip on the Foetal Heart

Half-hourly records are made of the foetal heart on the charts of all patients in labour. The only extra precaution taken in patients treated with the pitocin drip is that the house surgeon satisfies himself that no alteration in the foetal heart rate or rhythm occurs during the first half hour that the drip is running.

Of the 444 patients so treated, alteration in the rate or regularity of the foetal heart was noted on 45 occasions. Sometimes the rate of the drip was slowed, on a few occasions oxygen was administered to the mother, but it was only stopped on 8 occasions, twice within a few minutes of its institution. It is interesting to note that the drip had to be stopped in one patient because the foetal heart became irregular, but it was nevertheless used the next day without affecting its regularity. We have probably erred in not using the 1:10,000 solution of pitocin more often.

There were only 3 pitocin drip cases in which foetal death occurred during labour. One was a case of placenta praevia with a battledore insertion, carrying a large vein, in the lower segment. A stillborn infant was delivered with the forceps. The second, a case of impacted breech, has already been mentioned. In the third, foetal death occurred after the mother had been in labour for 72 hours, and the drip had been stopped for 24 hours.

It is unfortunate that we have no figures showing how often the foetal heart becomes rapid or irregular during the course of normal labour, but we are confident that with the ordinary routine first stage ward care there need be no untoward anxiety concerning the foetal heart attributable to the pitocin drip. Indeed, on not a few occasions, we have treated irregularity in rate and rhythm of the foetal heart by sweeping and rupturing the membranes, giving morphia, and setting up a pitocin drip. The 2 following illustrative cases may be quoted.

A primigravida, aet. 26, was admitted at 22.45 hours on 10th January, 1953, having been 12 hours in labour. She was given morphine gr. ¼ (16 mg.) and seconal gr. 3 (194 mg.), and two doses of 100 mg. of pethidine during the night. The next morning she was given an enema, and at 10.30 hours it was found that the cervix was still 3 fingers, the same dilatation as on admission. The membranes were swept and ruptured. Strong contractions occurred but the uterus remained tense in between the pains, in spite of 100 mg. of pethidine, which was repeated an hour later.

At 15.00 hours the foetal heart became grossly irregular and its rate had dropped to 100 a minute. The liquor amnii was meconium stained. The cervix was still only 3-fingers dilated and was oedematous. The foetal head was lying in the right occipito-transverse position at the level of the ischial spines. The experienced registrar reported that he was strongly of the opinion that immediate Caesarean section offered the only chance of obtaining a living baby.

At 15.30 hours oxygen was administered and morphine gr. ¼ (16 mg.), scopolamine gr. 1/100 (0·65 mg.), and sodium luminal gr. 1½ (100 mg.), were injected intramuscularly. The patient fell asleep and the foetal heart rate rose to 120, and became regular. The uterus relaxed completely between the pains.

At 16.00 hours a 1:5,000 pitocin drip containing 200

mg. of pethidine was commenced and run at the rate of 40 d/m. Strong uterine contractions occurred every 3 minutes, but relaxation between them was complete, and the mother was conscious of little or no pain.

At 17.50 hours the cervix was fully dilated and the head, which had partly rotated, was on the perineum and was delivered with the forceps. The baby weighed 7 pounds 14 ounces (3·5 kg.), and did well.

The procedure adopted at 15.30 hours should have been carried out at least 12 hours earlier, but the case provides striking evidence in support of the concept that inco-ordinate uterine action is due to extraneous factors, the effects of which can be inhibited by narcotics.

A gravida-2 (1 abortion at 3 months in 1953), was admitted in labour one week overdue, on the 27th January, 1956. The foetal heart rate rose to 180 and the membranes were swept and ruptured at 09.30 hours. She was given morphine gr. ¼ (16 mg.), and oxygen to inhale. The foetal heart rate dropped to about 140, but continued to be somewhat irregular. At 13.45 hours the foetal heart became grossly irregular and difficult to count. She was given morphine gr. ¼ (16 mg.), scopolamine gr. 1/100 (0·65 mg.), and sodium luminal gr. 3 (194 mg.), by intramuscular injection. Within a half an hour the foetal heart became regular and remained completely satisfactory until delivery was effected. At 17.45 hours the cervix was still only 1½ to 2 fingers dilated and the head was at the level of the ischial spines. Morphia gr. ¼ (16 mg.) was injected intramuscularly and she was given a 1:5,000 pitocin drip, 200 mg. of pethidine having been added to the glucose bottle. Four hours later the cervix was fully dilated and the head was on the pelvic floor. She was delivered by the forceps of a healthy infant weighing 7 pounds 3 ounces (3·2 kg.), just after midnight.

We have become increasingly convinced that irregularity of the foetal heart is almost invariably due to inco-ordinate uterine action and that resort to Caesarean section solely because of it is usually either unnecessary or useless. The proper treatment is sedation, and the simultaneous use of a variety of depressant drugs, for they all act at slightly varying levels on the central nervous system. The widely held fear that sedative drugs administered to the mother adversely affect the foetal heart is not supported by experience. An absolutely or relatively short cord (if it can be diagnosed) is probably the only condition which warrants abdominal delivery solely because of foetal distress. It is obvious that no useful purpose can be served in delivering by Caesarean section a foetus which has already sustained cerebral damage, or has a congenital malformation of the heart.

Forceps Deliveries

Of the 222 patients in whom labour was induced and who received a pitocin drip, 38 were delivered by the forceps, and in 3 of these cases the cervix was not fully dilated. Of the 216 uterine inertia patients who were given a drip, 74 were delivered by the forceps, and in 14 of these cases through an incompletely dilated cervix. Providing this operation is carried out in the obstetric theatre by an experienced obstetrician, no great risk is taken. The cervix, if it does not dilate easily, tears, but the rent can be easily sutured and there is rarely much bleeding. The fact remains that all the babies so delivered survived and went home well. There is, moreover, every reason to believe that the mothers concerned will be more easily delivered in subsequent pregnancies. The reported disasters have occurred when the forceps was applied to the cervix by inexperienced operators who did not realize that it was not fully dilated.

Caesarean Section

Of the 221 cases of induction of labour treated with the pitocin drip, 20 patients were ultimately delivered by Caesarean section, while 9 of the uterine inertia group were similarly delivered.

It would be wrong to assume that these cases represent failure of the pitocin drip for, of the 20 Caesarean sections in the induction group, 8 were performed because of cephalo-pelvic disproportion; 5 because labour did not progress satisfactorily after premature induction of labour for severe pregnancy toxaemia; and 1 because of a previous repair operation for uterine prolapse.

Similarly, in the uterine inertia group, 8 of the 9 operations were because of cephalo-pelvic disproportion, while the remaining patient had had a repair operation for uterine prolapse. Not only the weight of the baby, but also the age of the mother played some part in the decision to resort to this operation (see Table VI).

Hospital Foetal Wastage, 1954

It is generally agreed that the stillbirth rate rises to about 14 per cent if primigravidae are allowed to remain in labour for longer than 72 hours (Nixon, 1952; Ostry, 1955). It will be

seen from Tables VII and VIII that the numbers of cases of prolonged labour in Bradford fell from over 100 cases a year in 1947 to 1949 inclusive to 20 (of which 10 were unbooked) in 1954, and that this decrease cannot be attributed to a corresponding increase in the number of Caesarean sections. The two stillbirths in 1954 (Table VIII) occurred in non-booked patients who had been many hours in labour before admission. Seeing that there was no maternal mortality in either the induction or the inertia group, it is imperative to evaluate the foetal mortality with meticulous care. In order to show that there was no hidden pool of infant deaths

TABLE VII
The Results as Reflected in Foetal Wastage

	1947	1948	1949	1952	1953	1954
Total births in Bradford	6,334	5,439	5,048	4,744	4,653	4,702
Hospital deliveries	2,630	2,352	2,441	2,389	2,376	2,423
Cases of prolonged labour (more than 48 hours)	104 (16 not booked)	110 (13 not booked)	101 (32 not booked)	64 (10 not booked)	30 (10 not booked)	20 (10 not booked)
Caesarean sections (primary)	38	30	26	64	70	65
Caesarean sections (repeat operations)	24	30	24	28	25	23

[It has been claimed that sweeping and rupture of the membranes, the generous use of morphia and other depressant drugs, and the employment of the pitocin drip represent an important feature of hospital policy. The results are mirrored in this Table and in Table VIII.]

TABLE VIII
Table Showing the Duration of Labour in Patients Who Travailed for More than 48 Hours

Year	Over 48 Hours	Between 50 and 59 Hours	Between 60 and 69 Hours	Between 70 and 79 Hours	Between 80 and 89 Hours	Between 90 and 100 Hours	Over 100 Hours	Stillbirths	Infant Deaths
1947 ..	104	44	11	21	2	8	1	10	1 (2 lb. 4 oz.)
1948 ..	110	37	15	22	6	4	5	12	0
1949 ..	101	43	22	10	4	4	7	10	1
1952 ..	64	24	17	5	6	4	1	6	1 (5 lb. 10 oz.)
1953 ..	30	12	6	4	0	0	0	0	1 (9 lb.)
1954 ..	20	11	1	1	2	0	0	2	2 (4 lb. 7 oz.) (4 lb. 15 oz.)

The two stillbirths in 1954 were born to non-booked patients. During the years 1953 and 1954, 78 per cent of all booked primigravidae were delivered within 20 hours, and 92 per cent in under 30 hours, from the onset of labour.

[Comparison of certain results obtained during the 1947–49, and 1952–54 periods. The Caesarean section rate has risen somewhat since 1947, but this operation was used in 1954 to effect the deliveries of only 3·6 per cent of the infants. The figures for 1952–54 make it clear that the fall in the number of cases of prolonged labour from 64 in 1952, to 20 in 1954, could not be accounted for by an increase in the number of abdominal deliveries.]

unrevealed by the above figures, it is proposed to include an analysis of the total infant loss in 1954.

1954

Hospital Deliveries	No. of Stillbirths	No. of Infant Deaths	Total Foetal Wastage
2,423	104	53	157

Stillbirths

Booked Patients		Unbooked Patients	
Primigravidae	23	Primigravidae	15
Multigravidae	29	Multigravidae	37
Total	52	Total	52

Infant Deaths

Booked Patients		Unbooked Patients	
Primigravidae	15	Primigravidae	4
Multigravidae	20	Multigravidae	14
Total	35	Total	18

One hundred infants born to multigravidae, and 57 to primigravidae, were lost, a ratio of nearly two to one, although 44 per cent of the patients delivered in hospital were primigravidae. The average weight of babies born to primigravidae delivered in hospital was 7 pounds (3·2 kg.), and to multigravidae 7 pounds 8 ounces (3·4 kg.), but only 28 of the 157 infants lost weighed 7 pounds (3·2 kg.) or over, and of these 4 had malformations incompatible with life. In spite of our precautions a few infant deaths were due to postmaturity, but the foetal wastage was largely associated with prematurity, and be it noted in only a small percentage of cases was there any evidence of toxaemia in their mothers.

Stillbirths: 52 Unbooked

Of the 52 unbooked stillbirths, 46 of the infants, many grossly premature, were dead before their mothers were admitted to hospital, and the state of the remainder was parlous. The lie of 2 was transverse, necessitating internal podalic version, and 1 patient had a large cervical tumour which had to be removed before delivery could be effected.

Stillbirths: 52 Booked

Of the 52 booked stillbirths, 12 weighed less than 3 pounds (1·4 kg.), and 32 less than 5½ pounds (2·5 kg.). Twenty-one of the infants had died *in utero* and there were 6 anencephalic infants. Only 20 of the infants weighed 5½ pounds (2·5 kg.) or over, and of this number 8 had died *in utero*, 2 had hydrocephalus, and 1 showed hydrops foetalis. One infant, weighing 9 pounds 2 ounces (4·2 kg.), was delivered by the forceps to an eclamptic mother, while the delivery of 1 was associated with placenta praevia, the low battledore insertion which has already been mentioned. So far as the actual delivery of the patients was concerned, it is difficult to see how more than a small number of these babies could have been saved.

Infant Deaths in Hospital

Infant Deaths: Unbooked. Of the 18 infants of unbooked mothers who died, 8 weighed under 3 pounds (1·4 kg.), and 12 under 5½ pounds (2·5 kg.). Of the 6 infants who weighed 5½ pounds (2·5 kg.) or over, 2 showed malformations incompatible with life, 2 were delivered and were dead before admission, and one was born to an eclamptic patient.

Infant Deaths: Booked. Of the 35 infants who died, 19 weighed less than 5½ pounds (2·5 kg.). Of the 16 who weighed 5½ pounds (2·5 kg.) or over, 8 demonstrated malformations incompatible with life, 3 were born to pre-eclamptic mothers, and 2 with rhesus antibodies died either during or subsequent to replacement blood transfusion.

Further, many of the 31 premature infants died shortly after birth, for of the 159 admitted to the premature infants' ward in 1954, 22 died, and of these, only 6 weighed over 4½ pounds (1·9 kg.).

Of the total foetal wastage of 157, no fewer than 67 infants died *in utero* before labour commenced, 78 weighed less than 5½ pounds (2·5 kg.), and but few of the deaths could reasonably be attributed to the actual method and manner of delivery.

Discussion

If it be true that oxytocin is the hormone devised by nature to institute labour and effect

delivery it is evident that the fears of obstetricians the world over, concerning the use of the pitocin drip in all but normal cases, are groundless. It would also follow that inco-ordinate uterine activity must be due to factors superimposed on the normal contractions provoked by oxytocin.

We have reported the combined method of sweeping and rupture of the membranes, the full employment of morphia, scopolamine, and other depressant drugs, with the use of the pitocin drip. This triple procedure has been carried out by registrars and housemen in the ordinary antenatal and first stage wards and has formed an integral part of hospital policy.

Although the pitocin drip has been used on well over a thousand occasions, we have confined our report to the three years 1952–54 inclusive, because during that time the triple procedure became fully developed. Labour was induced either prematurely or at term in 1,030 patients, the pitocin drip being used in 222 of these patients. Of the 1,030 patients all but 20 were delivered *per vias naturales*. Of the 20 Caesarean sections, the majority were performed either because of cephalo-pelvic disproportion or for severe toxaemia.

Of some 600 cases of uterine inertia treated by rupture of the membranes, 216 were given a pitocin drip. Of the total number all but 9 were delivered *per vias naturales*. Of the 9 Caesarean sections, 8 were performed for cephalo-pelvic disproportion, and 1 because of a previous operation for prolapsus uteri.

The combined procedure, therefore, is equally, if not more efficient, in the treatment of uterine inertia as in the induction of labour. Only 3 mothers manifested pyrexia during the drip and in at least 1 of these cases it was due to infection of the urinary tract.

Assuming ordinary care, there need be no anxiety concerning the effect of the pitocin drip on the foetal heart. The drip must be shut off before it is connected with the needle in the vein, and then turned on very slowly, while observing its effect, if any, on the foetal heart. Under no circumstances should the dilution of pitocin exceed a strength of 1:5,000 when the drip is commenced, and it would probably be wise to start with a 1:10,000 solution. If neither of these concentrations of pitocin causes uterine contractions, a bottle of 1:2,500 dilution can be tried before the drip is discontinued. When the drip is recommenced the next day the minimal dilution of oxytocin must be used first. The drip, if ineffective, should not be left running for more than about 6 hours, but should be taken down so that the patient can rest adequately. Following an enema, the drip is restarted the next morning and, if labour proceeds satisfactorily, should not be taken down until the placenta is delivered. This prevents excessive post-partum blood loss.

The institution of the pitocin drip may cause immediate and effective labour pains. The following examples will be quoted:

1. Primigravida, aet. 31: Not in labour 12 hours after artificial rupture of the membranes (A.R.M.): pitocin drip 1:5,000 set up. Delivered 1 hour later of an infant weighing 7 pounds 8 ounces (3·4 kg.).

2. Primigravida, aet. 31: Internal conjugate, 8·25 cm.; brim area, 78 sq. cm.; in labour 36 hours; pitocin drip, 500 ml. of 1:5,000 and 500 ml. of 1:2,500 solution; spontaneous delivery some 4 hours later of an infant weighing 6 pounds 7 ounces (2·9 kg.).

3. Primigravida, aet. 36: hypertension; spontaneous rupture of membranes; inco-ordinate uterine action for 24 hours; pitocin drip 1:5,000; 1-finger dilatation of cervix to delivery in 2 hours; infant weighed 5 pounds 2 ounces (2·3 kg.).

4. Primigravida, aet. 26; A.R.M. after 12 hours in labour; 6 hours later pitocin drip 1:5,000; 2-fingers dilatation of cervix to delivery in 50 minutes; infant weighed 7 pounds 3 ounces (3·3 kg.).

On the other hand the drip may cause no uterine contractions at all, it may cause contractions without affecting the dilatation of the cervix, it may cause contractions which cause some descent of the presenting part and some dilatation of the cervix without instituting labour, for the pains cease when the drip is taken down. Labour may then start during the night and proceed to delivery. On the other hand the pitocin drip, which proves ineffective the first, and rarely the second day, may cause strong and productive pains on the third day. The following examples may be quoted:

1. Primigravida, aet. 25: Induction of labour; internal conjugate, 9·8 cm.; brim area, 99 sq. cm.; 1st day, drip ineffective; 2nd day, 3-fingers to full dilatation of cervix in 3 hours; spontaneous delivery of infant weighing 7 pounds 9 ounces (3·4 kg.).

2. Gravida-4, aet. 28; induced for postmaturity; 1st day fair pains but drip, 1:5,000 and 1:2,500, caused no

dilatation; 2nd day, 1:2,500 drip, 2-fingers dilatation to delivery in 2 hours; the infant weighed 8 pounds 4 ounces (3·8 kg.).

3. Gravida-3 (1 miscarriage), aet. 29; hypertension; 1st day drip caused no contractions; 2nd day it provoked pains which caused no cervical dilatation; 3rd day, 3-fingers dilatation of cervix to delivery in 3 hours; the infant weighed 8 pounds (3·6 kg.).

4. Gravida-3, aet. 31; no dilatation of cervix while drip was running; delivered spontaneously 6 hours later of an infant weighing 6 pounds 15 ounces (3·2 kg.).

Between 70 and 80 per cent of patients at term go into labour within from 12 to 24 hours from the time that their membranes are ruptured. Equally, the great majority of patients who fail to go into labour within this period of time do so almost immediately after the pitocin drip is employed. It has been pointed out that the drip is occasionally ineffective until the third day of its use, and at rare intervals a patient is encountered who fails to go into labour for several days, and such a recent case is reported. It may be observed that this delay in the sensitization of uterine muscle occurs in multigravidae as well as in primigravidae.

A primigravida, aet. 21, was admitted on the 21st January, 1956, for induction of labour, because the foetal head was free and she was a week overdue. The cervix was long and tightly closed, and hyalase and procaine were injected in the manner already described. The same night the membranes ruptured spontaneously, and, in view of the fact that the foetal heart rate rose to 168, a vaginal examination was made to make sure that the cord had not prolapsed. The cord was not felt and the membranes were widely swept, the hole in the membranes was enlarged, and as much liquor amnii as possible was allowed to escape. On the following three days a pitocin drip was used and caused no uterine contractions. It may be noted that on the third day acetlycholine was also used, and run in at the rate of from 10 to 25 mg. a minute. On the fourth day no drip was employed. The foetal heart nevertheless became rather rapid towards evening and she was given morphine gr. ¼ (16 mg.) together with scopolamine, gr. 1/100 (0·65 mg.), intramuscularly. On the 5th day she had some uterine contractions which became augmented by a 1:50,000 pitocin drip, but in spite of the fact that both a 1:10,000, and a 1:5,000 drip were subsequently employed, no advance in labour occurred. On the 6th morning she complained of pains at 02.00 hours and at 06.00 hours was given oleum ricini, 2 ounces, followed by an enema 4 hours later. At 08.00 hours the pains became strong, but the cervix was still only about 2 to 3 fingers dilated, and it was clear that she had developed inco-ordinate uterine action. She was given morphine gr. ¼. An hour later she was given pethidine 100 mg. together with scopolamine gr. 1/100 (0·65 mg.) by intramuscular injection. At 11.15 hours the cervix was no further dilated and the head was at the level of the ischial spines. A 1:10,000 pitocin drip, containing 200 mg. of pethidone was commenced. The cervix was fully dilated at 12.55 hours, and at 13.25 hours the patient gave spontaneous birth to a daughter weighing 6 pounds 10 ounces (3 kg.).

This case might be quoted as evidence of failure of the pitocin drip, but we regard it as very strong evidence in favour of the view that labour does not occur until the uterine muscle becomes sensitized to oxytocin. We have never seen labour occurring until this sensitization becomes manifest, and we have never encountered a woman in labour in whom oxytocin was without effect.

Further, this case also shows that inco-ordinate uterine activity can be controlled by depressant drugs, and that the pitocin drip can be used with safety and benefit once they have been satisfactorily employed.

The foetal wastage has been reported in detail and it is very evident that, whatever the shortcomings which allow such wastage of premature infants, the loss of infants due to the method of delivery was exceedingly small, it being calculated that not more than 19 of the 157 infants lost in 1954 could have been saved.

Impact of the Triple Procedure on the Method of Delivery

It is possible that a decreasing number of obstetricians regards Caesarean section in a young woman as a mutilating operation which indirectly involves grave ethical problems. The facts remain that Caesarean section is associated with a higher maternal mortality than normal delivery; that a young woman once she has had an abdominal delivery is precluded during pregnancy from travelling in complete freedom; that many women think that it is their right to demand sterilization at the second or third section; and that even lower segment scars rupture during labour. The staggering increase in the number of Caesarean sections in this country and in America does not merely reflect the adoption of a safe and easy way out of trouble, but is very largely a measure of the fear of losing the baby.

There is, moreover, a widely held conviction

that the alternative so often lies between Caesarean section and dragging out a dead foetus through the vagina. Not all babies delivered by Caesarean section survive and there can surely be no more fruitless procedure than delivery of an infant with some congenital malformation through the abdomen, when the sole criterion for performing the operation was irregularity of the foetal heart. It is also largely overlooked that the very factors which have reduced the dangers of Caesarean section likewise reduce the risks of vaginal delivery.

We feel justified in saying that the triple procedure works, that at no time was any anxiety incurred with regard to the mother, and that during the whole of 1954 only 24 viable babies weighing 7 pounds (3·2 kg.) or over were lost. We are convinced that with the further development and the more complete adoption of this procedure the incidence of Caesarean section can be still further lowered.

Theoretical Considerations

The milieu of the uterus is conditioned by hormones, enzymes, nervous impulses, and the electrolyte and water balances of the body, and if it is grossly disturbed neither conception nor pregnancy can occur. The fact that a completely isolated dog's uterus perfused with Locke's solution can expel foetuses at term by means of slow, rhythmic, intermittent contractions (Kurdinowsky, 1904) does not imply that the act of parturition is not normally affected by the operation of divers antagonistic controls, both nervous and hormonal. It does, however, prove that rhythmical and co-ordinated uterine contractions can occur apart from nervous impulses. The sparseness and uneven distribution of for the most part unmyelinated nerve fibres to the uterus, most of which supply the lower uterine segment, cervix, and vaginal vault, and the absence of nerve ganglia and plexuses in uterine muscle, would lead to the anticipation of such a result.

Recent work (Woodbury and Abreu, 1944; Kaiser and Harris, 1950) suggests that adrenaline administered in physiological dosage temporarily inhibits uterine activity, although this apparent inhibition may in fact be due to blocking at different points of the transmission of normal rhythmic contractions (Haterius and Ferguson, 1938). The temporary cessation of effective labour pains associated with the doctor's entry may therefore be attributed to a momentary outpouring of adrenaline. On the other hand, both the intravenous injection of noradrenaline (the chemical transmitter substance at adrenergic nerve endings) and stimulation of the hypogastric nerves invariably cause constriction and pallor of the uterus and a decrease in its blood supply (Langley and Anderson, 1895; Schofield, 1952). Nobody has succeeded in causing relaxation of the uterus by stimulation of any nerve.

It is therefore reasonable to assume that efferent uterine nerves may be concerned with the tone of the lower uterine segment and cervix, and with co-ordination between fundus, parametric tissue, and cervix. It may be stated in parenthesis that the parametric tissue plays a much more important part in parturition than is generally realized. The evidence reported above and the known anatomical distribution of uterine nerves makes it reasonable to postulate that spasm of the cervix, constriction ring, inco-ordinate activity and hypertonicity of the uterus during labour are to be attributed, in the absence of maldevelopment of the uterus, to abnormal and unbalanced activity of the efferent uterine nerves. The stimulus which provokes this abnormal activity may arise centrally, from fear and other emotions, or in the pelvis because of dystocia.

Strips of human muscle show progressive alteration in sensitivity to oxytocin, vasopressin, and ergotoxin during pregnancy (Robson, 1933), but this degree of alteration in sensitivity to oxytocin is altogether of a different order from the more than two hundredfold (possibly thousandfold) increase which occurs before labour supervenes. The intramuscular injection of 10 units of pitocin into a woman at term may not cause a single uterine contraction, nevertheless within 24 to 48 hours an intravenous drip delivering 0·5 mU (40 d/m of a 1:50,000 dilution) of pitocin a minute may suffice to initiate or augment and regularize labour pains. This time interval may be reduced to 12 hours by the simple procedure of rupturing the membranes. Indeed, if the injection of pitocin

at term causes no uterine contraction, the obstetrician can go away for the weekend always providing the membranes do not rupture so soon as he departs.

It is reasonable to postulate, without denigrating the importance of the many other factors involved, that this invariable and remarkable alteration in the sensitivity of uterine muscle to oxytocin is the dominant factor in the causation and completion of labour. This postulate poses 4 questions: (1) is this alteration in sensitivity due to the sudden withholding of some inhibiting substance or to the sudden and purely temporary release of a new hormone; (2) does the degree of sensitivity to oxytocin attained by uterine muscle vary within wide limits?; (3) do the corpus, lower segment, and cervix become equally sensitive to oxytocin?; (4) how is this change in sensitivity of uterine muscle to oxytocin effected?

Is this Alteration in Sensitivity Due to the Sudden Withholding of Some Inhibiting Substance or to the Sudden and Purely Temporary Release of a New Hormone?

It must be clearly stated that the answers given to these questions are largely speculative, but they are consonant with known facts. The non-pregnant uterus tends to expel a small balloon (Garret, 1955) or an intramural fibroid. During 1954 over 700 abortions or miscarriages were dealt with in this hospital and a considerable number must have occurred in the city. During the same year over 300 premature births occurred in hospital. Even if a high proportion of the abortions were self induced, the fact remains that they were easily induced and usually by some form of vaginal douche.

It therefore seems reasonable to assume that the normal response of the uterus to the presence of the growing embryo would be to expel it were it not for the operation of some powerful inhibiting factor which is presumably set in motion early in pregnancy. We feel that this inhibiting factor must be of an hormonal nature, and seeing that it is not progesterone, we postulate that it is secreted by the anterior pituitary gland (see Pencharz and Long, 1933).

Does the Degree of Sensitivity to Oxytocin Attained by Uterine Muscle Vary Within Wide Limits?

One milligramme of the crude post-pituitary extract contains 1 international unit of both oxytocin and of ADH. It is not yet decided whether both activities are effected by one large molecule or whether each hormone is a separate substance which can be liberated independently of the other. Animal experiments have so far been too crude to settle this point (Harris, 1947, 1948; Abrahams and Pickford, 1954; Van Dyke, Adamson and Engel, 1955). It is known that the intravenous injection of from 0·25 to 2 mU of ADH a minute suffices to cause from minimal to fairly complete inhibition of water diuresis in man (including the pregnant woman) and in the dog, and that the results obtained are consistent and reproducible.

It has been found, in quite a considerable series of cases in Bradford, that a drip delivering 0·5 mU of pitocin a minute (40 d/m of a 1:50,000 dilution) often suffices to institute labour or to augment and regularize uterine contractions, and this fact is the most important single piece of evidence in favour of the hormonal nature of oxytocin. If Abel's unitary hypothesis of post-pituitary substance be correct, it would follow that the pitocin drip given in a range of dilutions from 1:100,000 to 1:12,000 (40 d/m) should suffice to institute labour, providing the uterine musculature had attained its maximum sensitivity to oxytocin. The varying secretion of urine during labour is in accord with this supposition. On the other hand, we have usually had to use from 2·5 to 5 times the maximum postulated physiological amount of pitocin in the drips which we have reported. The point which remains to be determined is whether the uterine musculature of the in some ways abnormal patients to whom we gave the drip had in fact attained the maximum sensitivity to oxytocin. We think we can devise a means of settling this point but for the present would point out that in some patients the intravenous administration of 0·5 mU of pitocin a minute sufficed to institute labour, in a great number the extreme physiological range of 2 mU a minute sufficed and finally that in quite a few cases the maximum increase in sensitivity of

uterine muscle to pitocin following rupture of the membranes was delayed for several days, and its daily increase could be measured.

The practical point to bear in mind is that the sensitivity of uterine muscle to oxytocin may alter while the drip is actually running and it is therefore never safe to employ the pitocin drip in greater dilution than 1:2,500 or 5 times the postulated extreme physiological dosage. It may be stated in parenthesis that the reason pitocin is used in the drip rather than post-pituitary extract is because of the antidiuretic activity of the latter substance. In some patients the mere introduction of fluid into the vein may, for varying reasons, cause a rise in the blood pressure, but it is fanciful in the extreme to imagine that pitressin, in the dilutions used in the drip, could cause any rise in the maternal blood pressure. Indeed pitressin should be renamed antidiuretin, for it is becoming increasingly evident that the post-pituitary gland does not secrete a pressor hormone (Theobald, 1955, p. 79).

Do Corpus, Lower Uterine Segment, and Cervix Become Equally Sensitive to Oxytocin?

Newton (1937) reported that the *cervix uteri* of the rat and guinea pig did not react *in vitro* even to large doses of oxytocin, and concluded that if this were not the case severe uterine inco-ordination would be provoked. Adler, Bell and Knox (1944), using the same animals and the cat, failed to confirm Newton's observations, but they did find that "the cervical response to a given dose of oxytocin was of much shorter duration than that of the cornu". If these observations applied to man it would clearly explain how parturition could be occasioned by oxytocin without the danger of precipitate labour (Bell, 1952). Schild, Fitzpatrick and Nixon (1951) noted that the human cervix from the 8th to the 24th week of pregnancy may either contract or relax after an intravenous injection of pitocin, and all observers are agreed that the cervix and corpus uteri may show independent spontaneous activity in both the pregnant and the non-pregnant state.

How is this Change in Sensitivity of Uterine Muscle to Oxytocin Effected?

Page (1947) claimed that pitocinase was formed by the placenta and inactivated the pitocin circulating in the blood, and Bender (1954) suggested the possibility that reduction of the amount of pitocinase in the blood might be a factor in the causation of the onset of labour. This attractive speculation cannot however be entertained for several cogent reasons. In the first place the evidence in favour of the existence of pitocinase is not very convincing and the same type of evidence has been used to postulate the presence of a substance which inactivates ADH (Küstner, 1927; Shockaert and Lambillon, 1936). It has, however, repeatedly been shown (Theobald, 1934a, b, 1955) that the intravenous injection of ADH is usually equally efficacious in inhibiting water diuresis in pregnant women as in non-pregnant women, men and dogs.

It is probable that the uterus would be most stimulated to expel its contents between the 6th and 10th weeks of pregnancy, before the placenta is formed (see Garrett, 1955). Further, it is conceded that the level of "pitocinase" in the blood decreases in patients with pregnancy toxaemia, and it is often very difficult to induce labour in such patients. Then, too, rupture of the membranes suffices to induce labour in about 70 to 80 per cent of primigravidae within from 12 to 24 hours, and it is not easy to conjecture how such a procedure could affect the amount of pitocinase liberated by the placenta. Finally, the most important objection of all is that uterine muscle may remain quite insensitive to large doses of oxytocin up to the onset of labour.

Although efferent uterine nerves play no part in the conduction of the waves of uterine contraction and may cause inco-ordinate and hypertonic uterine activity, afferent uterine nerves, about which little is written, probably play a most important part in causing the onset and continuation of labour. The escape of an adequate amount of liquor amnii usually causes the woman at term to go into labour within from 12 to 24 hours. The only explanation that occurs to us is that the alteration in uterine tension so effected causes impulses to travel to

the hypothalamus. These indirectly cause the anterior pituitary gland to stop releasing the hormone which desensitizes uterine musculature to oxytocin, and the posterior gland to increase release of the latter hormone.

In the ordinary course of events the Braxton Hicks contractions and the descent of the presenting part ultimately cause the same effects. The abdominal musculature is tensed with every strong uterine contraction (as can be demonstrated by measuring either the rectal or intra-vesical pressure), but when the presenting part directly stimulates the vaginal walls a reflex is instituted which causes fixation of the diaphragm and expulsive efforts. It seems to us that the only valid reason for maintaining a drip which causes inadequate uterine contractions is that the afferent impulses to the hypothalamus so provoked may indirectly aid in the sensitization of the uterine muscle to oxytocin.

In case this view of the importance of afferent uterine nerves during labour is deemed overstressed the following evidence will be adduced: the pains of labour may be abolished by the subcutaneous infiltration of the ilio-hypogastric, ilio-inguinal, and pudendal nerves with a 1 per cent solution of procaine "but if this is effected too early the patient goes out of labour until pain recurs" (Theobald, 1936, 1941); the release of both oxytocin and ADH can be provoked by a whole range of simple procedures (Abrahams and Pickford, 1954) and even by suckling (Cross, 1951; Kalliala *et al.*, 1951, 1952); oxytocin release can be caused by stimulation of afferent vagal fibres (Chang *et al.*, 1938); and ADH release in the dog can be caused by introducing a needle into the tissues between the lumbar vertebrae and in man by stimulating the cervix uteri (Theobald, 1936, 1941).

We therefore suggest that hypothalamic activity involving the pituitary gland is the key to pregnancy and to labour, and that excessive liberation of noradrenaline at uterine motor nerve endings, for which the hypothalamus may not prove guiltless, is the cause of uterine inco-ordination.

It is a matter of profound satisfaction that the ordinary obstetrician, working in his wards, can demonstrate, record, and measure reproducible effects on both uterine action and urine flow, caused by the intravenous injection each minute of from one hundred-thousandth to one two-millionth part of a gramme of post-pituitary extract. When it is remembered that both purified oxytocin and synthetic oxytocin may be some 500 times more potent than the commercial pitocin (Pierce, Gordon and Du Vigneaud, 1952), and that this amount of substance is injected into 4 litres of blood, it will be realized that he is measuring effects caused by an added concentration of oxytocin each minute in the blood of the order of from 2×10^{-11} to 4×10^{-12} of a gramme. Neither is it likely that this added amount of oxytocin will accumulate in the blood for it seems to be inactivated rapidly, seeing that uterine contractions caused by a pitocin drip cease almost as soon as the drip is discontinued, unless labour has supervened.

He is, moreover, able to demonstrate that the post-pituitary gland does not secrete a physiological pressor substance, and to obtain evidence, even on such a problem as the separate release of oxytocin and ADH, which is denied to physiologists.

Summary

It is suggested that parturition occurs as the result of a more than hundredfold increase in the sensitivity of uterine muscle to oxytocin. This is normally effected over a period of days or hours at or about term, but may take place at any time during pregnancy.

Evidence has been adduced to show that inco-ordinate uterine action is due to excessive or irregular activity of the motor fibrils of the autonomic nerves supplying the uterus, and can be abolished by deep sedation. It may be necessary to use three separate narcotic drugs to achieve this purpose, for each acts on the central nervous system at a slightly different level.

Irregularity in the foetal heart is usually due to inco-ordinate uterine action which may occur early in labour. Foetal distress may be associated with maternal distress, but maternal distress can occur without any irregularity of the foetal heart. The treatment, unless immediate vaginal delivery is reasonably easy, is deep sedation.

We have reported the use of the triple pro-

cedure, which consists of low rupture of the membranes, deep sedation, and the pitocin drip. Each procedure is dependent on the other, and the first two decrease the number of occasions on which the third proves necessary.

Of 1,030 patients in whom labour was induced the pitocin drip was used in 222 of them (22 per cent), and all but 20 were delivered *per vias naturales*. Of 600 cases of uterine inertia the pitocin drip was used in 216 (36 per cent), and all but 9 were delivered vaginally.

The triple procedure makes it possible to reduce the incidence of Caesarean section to the minimum.

The incidence of forceps deliveries was high, particularly in the inertia group. Fourteen of the patients in this group were delivered through an incompletely dilated cervix, but all the babies were born alive and went home.

Primigravidity, maternal age, and the weight of the infant (which includes the concept of cephalo-pelvic disproportion) play an important part, particularly in the inertia group, in determining the mode of delivery.

It is desirable to start the pitocin drip in a dilution of 1:10,000 never in a concentration exceeding 1:5,000. On no occasion should a concentration exceeding 1:2,500 ever be employed, for the sensitivity of the uterine muscle to oxytocin may increase while the drip is being used.

If these precautions are strictly adhered to, the routine use of the pitocin drip is safe in all patients who are allowed to go into labour.

It is suggested that the hypothalamus is responsible for the onset of labour and parturition, and that noradrenaline causes incoordinate uterine activity.

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A CLINICAL INVESTIGATION INTO UTERINE PROLAPSE WITH STRESS INCONTINENCE TREATMENT BY MODIFIED MANCHESTER COLPORRHAPHY

Part II

BY

K. VERNON BAILEY, *M.C.*, M.D., M.R.C.P., F.R.C.O.G.
Manchester, England

SOME two years has now elapsed since Part I of this paper was published in this Journal, and about 4 years since I began to practise the technique of modified colporrhaphy which was described in it.

In Part I a follow-up of 209 cases of prolapse treated by the Manchester Colporrhaphy alone during six years was conducted. This showed that there were 83 cases of this series in which stress incontinence had been complained of and of these, as the result of the operation, there were 32 symptomatic cures, 20 part cures and 31 failures. In this series only symptomatic cures could be assessed on account of the lack of pre-operative cysto-urethrogram X-ray evidence.

In spite of this lack of pre-operative X-ray confirmation of symptoms, however, it was found that in these 32 symptomatic cures post-operative cysto-urethrography showed 29 normal bladder appearances (after the technique of Jeffcoate and Roberts) and in the 51 complete or partial failures that there were 44 which demonstrated either complete or partial loss of the posterior urethro-vesical angle on straining.

In this follow-up series, therefore, it was found that the X-ray appearances of the bladder and urethra conformed in accurate degree to that which had been described by Malpas, Jeffcoate and Roberts (1952).

In Part I also a control series of 25 cases of prolapse (10 with and 15 without stress incontinence), in which a pre-operative cysto-urethrogram had been taken, were operated upon by colporrhaphy only. This was done to find out the effect, if any, that the Manchester colporrhaphy would have in (1) the elevation of the upper urethra and (2) the restoration of the P.U.V. (posterior urethro-vesical) angle.

In this series the 10 cases with stress incontinence showed 4 symptomatic and anatomical cures, 2 part cures and 4 failures. The 15 cases without S.I. (stress incontinence) all showed some degree of improvement in the post-operative cysto-urethrogram which in all cases conformed to the clinical features.

In this series therefore I was able to assure myself that the Manchester colporrhaphy could produce a complete cure in definite stress incontinence, but not in more than 50 per cent of the worst cases. I also found that the Manchester colporrhaphy effected an improvement in most of the others even to the extent of almost curing some. There were however some others which showed no benefit either symptomatically or anatomically as the result of colporrhaphy alone, and it was, of course, these coupled with even the part cures which formed the basis of my first enquiry.

The modified colporrhaphy which evolved from this was presented in a series of 35 cases of which 10 had previously been operated upon by colporrhaphy and in which the S.I. factor remained uncured. In this series the 4-months follow-up and cystogram showed 32 symptomatic and anatomical cures. The other 3 cases could be classified as part cures with both symptomatic and anatomical improvement shown.

In the new series of 215 cases from which 25 of the above cases as well as the 25 cases of the control series were drawn, it was shown that 83

complained of stress incontinence. Of this proportion I estimate that rather more than one-third would be likely to show a sufficiently abnormal cystogram and at the same time to possess the symptom of S.I. to a sufficiently severe degree to warrant the performance of the modified colporrhaphy, on the scientific assumption that the Manchester colporrhaphy alone would be unable to produce a permanent symptomatic and anatomical cure. In my present annunciation I endeavour to reduce this generalization to a more precise assessment of the types of case in which the modified colporrhaphy is indicated.

After describing the technique of the operation of modified colporrhaphy in Part I, therefore, I concluded that "all cases of uterine prolapse in which stress incontinence is complained of should be submitted to a pre-operative investigation which includes cysto-urethrography". Of this I am quite convinced, just as I am that the bladder and urethra configuration which conforms to S.I. is a constant one within reasonable limits and one which can be scientifically co-related with the symptomatology. As has been said by Malpas, Jeffcoate and Roberts (1952), and confirmed by myself, there are a few quite atypical cases difficult to explain, but so few that they do not in any way vitiate the clinical scientific picture or in any way render less precise the type of treatment which should be adopted. A symptomatic cure can be anticipated on comparison of the post-operative and pre-operative films.

Further Investigations

Since completing the initial investigation I have continued to submit to a thorough examination and cystogram all cases of prolapse with stress incontinence attending at the out-patient clinic. The operation of modified colporrhaphy has continued to be performed, and the immediate 3–4 month X-ray follow-up has also continued. The results have remained uniformly good from both the symptomatic and anatomical points of view. Certain details in the operative technique have proved useful and have helped to simplify it. These I shall explain. Some minor complications and additions also need explanation.

In order to further impress myself of the limitations of the Manchester colporrhaphy alone in this connexion, I have carried out another colporrhaphy control series of 15 cases. These are all cases of stress incontinence, but the cystogram contains examples of the supported upper urethra as well as of gross rotational descent of it in conjunction with the loss of the posterior urethro-vesical angle. These results are anatomically illuminating and serve to uphold my former belief. A further series of cases of modified colporrhaphy have been assessed at approximately 4–6 months post-operatively.

The 2-year follow-up has been conducted both in the case of the first colporrhaphy control series and also in 3 cases of modified colporrhaphy carried out prior to January, 1954. It is interesting to see how the support afforded by these operations stands up to the strain over a period of 2 years. Here again the results fully justify my beliefs. Probably the 2-year result might represent the permanent result—as far as an operation of plastic type can be expected to attain to this. It indicates the strength and firmness of the replaced organs and tissues and their ability to maintain themselves over a length of time. Perhaps a 5-year result might be even more convincing, but this would have its hazards in so far as the tissue change, trauma or atrophy would be brought into account. I trust however to supply this at a later date! In the meantime one might read from the 2-year film enough to indicate the efficiency or otherwise of an operation designed to replace by uplift pelvic floor organs which are themselves subject to constant day to day strains and by the use of tissues and muscles which have already been devitalized by trauma and weakened by years of abnormal neuro-muscular activity.

Cystogram Interpretation

During the last 4 years the X-ray Department of St. Mary's Hospitals under the directorship of Dr. J. B. Hartley has examined by cysto-urethrography some 350 of my own series of cases. In the earlier cases three exposures were taken, at ease, on straining and on micturition. Later the micturition film was discontinued. A large percentage of these cases have now had the 4-month and 2-year follow-up cystogram. This

work has therefore necessitated over 1,000 exposures of the bladder region to X-ray.

In studying these, I have further confirmed my belief in the initial work of Malpas, Jeffcoate and Roberts (1954), but, as they say, one is constantly confronted with what might appear to be atypical types. The shape of the bladder itself and the length and direction of the urethra may vary. The actual P.U.V. angle may be short in length or long, normal or impaired to something between 95 and 180 or totally lost to the region of 180. Funnelling of the urethro-vesical junction and diverticula or herniae of the trigone or contraction of the detrusor may alter the appearance. To those who do not see many of these films these characteristics may present some difficulty in the interpretation of the film, and generalizations in descriptive phrases such as "improved film", "impaired angle", or "part cure", become confusing. Although, therefore, these variations are always liable to cloud the true picture, and, as one must expect, there are multiple minor variations in the bladder outline possible at all times, one can nevertheless arrive at a practical assessment of the picture by viewing it against the background of three basic types of film together with one transitional type.

For descriptive purposes, therefore, I should like to divide the appearances of the straining films into these 3 main types and to indicate the position of the transitional type. I find the recognition of these types of straining film to be important in so far as I believe they represent a physiological behaviour which is to be expected on anatomical grounds and consequently one which will tend to react to the application of operative treatment in a manner to be expected.

As described in Part I, I believe that the upper urethra is maintained in elevation and the P.U.V. angle in integrity by the supporting and contact effects of the superior and inferior tendinous and muscular supports to the upper urethra. These three basic types of film indicate the adequacy or inadequacy of these supports, and consequently the type of operation needed and the effect produced by operation.

Following this assumption, therefore, in the subsequent text I have used these three types of straining film in order to indicate more clearly the degree of traumatic weakness, the necessity for the type of operation, and the degree of results obtained than could be done by previous generalization.

TYPE A

The Overall Normal Type of Straining Film

This varies from the strictly normal outline which features the well elevated urethra, at ease bending to 10 to 15 degrees on straining with about 2 cm. descent in conjunction with the normal 95/100 P.U.V. angle, to the well bent urethra on straining, with or without cystocele, but with a still perfectly maintained P.U.V. angle and a urethra which enters the U.V. (urethro-vesical) angle always at a level above the horizontal.

Type A(1)

Concerns this normal film in which the upper urethra remains above 45° to the perpendicular on straining.

Type A(2)

Concerns this normal film in which the upper urethra descends to or below 45° to the perpendicular on straining.

Patients showing a cystogram of Type A, therefore, as also in Type B(1), C(1) and C(2), do not suffer from true stress incontinence. They may simulate it as the result of a combination of obesity, cystocele, inefficacy of the compressor urethrae, vaginitis, cystitis, urethritis or trigonitis, but treatment of these factors in conjunction with colporrhaphy can effect a cure.

TYPE B

The Impaired or Lost P.U.V. Angle with Well Supported and Straight Urethra

The ease film is usually of the normal type. This straining film shows a urethra which descends to a normal or rather more than normal degree in conjunction with a P.U.V. angle which is partly or wholly lost to between roughly 12° and 15° degrees.

The urethra however remains straight—probably accentuated by the inferior weakness—and there is no rotational descent of it at the level of the triangular ligament. This indicates

the maintenance of the supero-lateral supports:

This picture, which is very common, may indicate that the tendinous supero-lateral supports from the pubo-rectalis to the upper urethra are still largely intact but that the muscular infero-lateral supports running from the pubo-rectalis to the under surface of the upper urethra in the region of the urethro-vesical junction are traumatized or paralysed.

It may well be that the intimate supporting contact given by these fine muscular elements to the antero-lateral vaginal wall and under surfaces of the upper urethra in the region of the urethro-vesical junction may form the complementary factor necessary to the maintenance of tone in the intrinsic muscles of this region and consequently the maintenance of the normal P.U.V. angle.

This impression has often been confirmed in my mind by the fact that clinically some of the worst cases of stress incontinence show a picture which conforms to Type B(2).

The upper urethra is still held up by the strands of upper tendinous support, but the inferior supports are destroyed and the intrinsic muscles at the utero-vaginal junction are paralysed. This anatomical possibility may account for the fact that Type B(2) cases not only often show the worse symptoms of stress incontinence but also show the worse results to colporrhaphy. This is understood by the fact that the uplift provided by urethral bolster is still handicapped by a lack of sub-upper urethral muscle contact. Indeed the few anatomical failures following the modified colporrhaphy have been in this type.

Operatively, therefore, I consider that cases of Type B(2) will need the modified colporrhaphy and those of Type B(1), where only slight stress incontinence may be present and where some sub-urethral muscle tone may still exist, may be adequately dealt with by colporrhaphy alone.

TYPE C

The Grossly Rotational Descending Upper Urethra in Combination with Types (A) and (B)

In these straining films the upper urethra bends acutely at the level of the triangular ligament. This type is usually preceded by an ease film which shows an abnormal degree of urethral deviation from the perpendicular—probably about 35°.

This type of straining film proceeds to a stage where the rotational urethral angle becomes more and more acute—with or without cystocele—but with a discernible A.V.J. still maintained, until eventually there is complete loss of P.U.V. angle with gross urethral collapse and probable funnelling, as the result of a combined inferior paralysis.

I suggest that this type indicates the progressive loss of the supero-lateral tendinous supports, in combination with Types (A) and (B).

This marked rotational descent of the upper urethra on straining is significant of the loss of the supero-lateral tendinous supports (through direct trauma in labour). The degree to which the P.U.V. angle is lost might depend on the degree of rotational descent on straining thus permitted and the degree to which the inferior supports are also affected. In the extreme case Type C(3) the inferior muscle supports are also paralysed—combination with B(2). Various degrees are demonstrable.

In other cases the upper urethra will ultimately enter the U.V.J. at a level below the horizontal, but with a discernible junction, and this is tantamount to a partial loss of P.U.V. angle even if masked by cystocele—combination with B(1).

In the more marked of these cases, therefore, of Type C(3) the modified colporrhaphy is indicated as the bolster possible with colporrhaphy only will not elevate the upper urethra sufficiently or permanently to offset the lack of its supero-lateral supports—a fact which throws the total strain on the bolster post-operatively. Moreover the lost sphincteric tone due to lack of inferior supports will not be re-established.

There is no doubt that the permanency of the anatomical cure depends very much on the extent to which the upper urethra can be elevated at operation with maximal elevation towards the perpendicular. Pelvic floor strains thereafter will approximate to its long axis and have minimal effect on forcing it downwards. In these cases showing rotational descent a

bolster below the distal urethra even combined with an attempted approximation of the puborectalis below the upper urethra is likely to elevate the latter to a limited degree only. Continued strain thereafter will be directed across its transverse axis and will be borne by the bolster alone. In the obese subject particularly therefore the tendency to further rotational descent will be constant.

Transitional Type (Type AB)

There remains the transitional type of straining film. I have not included this in the three main types because I believe that it represents a transitional and transitory phase between Type A and Type B(1) and for purposes of clinical assessment and operative application can be regarded as a weak Type A.

This straining film which is seen frequently—both pre- and post-operatively—is one in which the whole urethra is well supported and enters the U.V.J. at a normal type, but abnormally short angle.

Sometimes this P.U.V. angle is so short as to appear almost as a small notch at the posterior junction. Alternatively, the bladder base may make a slightly longer angle, but in many of these cases the transition from Type A to Type B is obvious.

I regard the anatomical cause for this to be due to a marked but not complete traumatization of the inferior muscle supports—whereby a partial intrinsic muscular tone is still maintained, but a degree of paresis has become initiated.

These cases do not suffer from stress incontinence, but one has the impression that any further deterioration might lead to it. In pre-operative assessment therefore they are suitable for colporrhaphy alone. Alternatively this type of film may be produced by operation—either colporrhaphy or modified colporrhaphy in cases of primary B or C type. If so, the inference is that the intrinsic tone and P.U.V. angle have been restored as the result of the uplift, but these are relatively weak probably as the result of excessive pre-operative trauma, poor tissue quality or marked atony at the U.V.J. In such cases, therefore, the improvement to the AB type would represent a cure, but a questionably permanent one—as slight improvement or disimprovement occurs subsequently. In the modified colporrhaphy results, therefore, I have reported these as probable cures.

Clinical Assessment

I have mentioned these three types of cystogram picture in order to facilitate a clinical-scientific correlation. There are of course other appearances seen on X-ray capable of intriguing interpretation. There are also many variations existing within the limits of these three types, but one might suggest that by and large patients who suffer from stress incontinence, which can be proved or disproved clinically or who do not indeed suffer from stress incontinence, can be physiologically assessed with reasonable accuracy against a background of these cystograms. Types can moreover be allotted to the operation—either colporrhaphy or modified colporrhaphy—which is indicated in their particular case.

The severity of the symptom, the age of the patient, her degree of obesity and suitability for operation, the degree to which the symptom affects or undermines her general or nervous health and the matter of previous plastic operation, must be correlated with the picture.

However in Type B I should advise the modified colporrhaphy in all cases of proved stress incontinence with a cystogram conforming to Type B(2). This I consider to be very resistant to colporrhaphy alone. Types A, B(1) and C(1) should respond to colporrhaphy alone.

With regard to Type C, patients with definite symptoms confirmed clinically and with a picture conforming to C(3) should be operated upon by the modified colporrhaphy. It is useless in these cases, particularly the more obese subjects, to attempt to lift the upper urethra to the optimum position by colporrhaphy alone. In Type C(1) and C(2) colporrhaphy alone can effect an improvement to Type A or AB. In my control series, all but 2 cases show some improvement from colporrhaphy alone but in my opinion not enough—that is to say, in the degree of return to normal not enough to guarantee that a cure of the stress incontinence factor will result over a length of time—say 2 years—which will represent in effect a positive

return of tone to the intrinsic musculature at the U.V.J.

I have nevertheless been surprised by the extent to which it has sometimes been possible to elevate the upper urethra by dragging the pubo-rectalis together from below. This undoubtedly accounts for the good results seen in some of the control cases, and in my opinion is due to the fact that the pubo-rectalis muscles in certain favourable cases are still intact and fairly well developed and their approximation is favoured by the fact that, as Naunton Morgan (1949) has pointed out, they tend to undergo a lateral twist as they pass the region of the antero-lateral vaginal wall thus presenting their under surfaces towards each other. Nevertheless this approximation is made by dragging them laterally inwards at right angles to their normal line of descent and therefore must be made under tension—a condition which does not favour permanent healing even in these favourable cases which cannot be assessed before or even at operation. A good result by this means therefore becomes a chancy affair from the scientific point of view. No reasonable guarantee of success can be given beforehand. In a large percentage of my cases I have found that the pubo-rectalis muscles are extremely thin and fragile. In 4 cases the muscle has been observed to be torn off its origin and retracted away from the bone on one side as the result of old trauma. In such cases as these, therefore—and any case may show this state of affairs—lateral traction by suture would only result in further laceration and stripping without beneficial effect; and this would not be fully appreciated at operation except perhaps by the appreciation of the fact of excessive bleeding.

Further Notes on Operative Technique

Since my previous communication I have carried out the modified colporrhaphy in a further 45 cases, and as the result one might stress again the following points which help to simplify the technique.

(1) The importance of the modified lithotomy-Trendelenburg position. By using this position the operation, which suffers from the fact of having two approaches, can be carried out without readjustment of operating or instrument tables or anaesthetic apparatus and re-towelling.

(2) A Malecot No. 4 catheter is used to define the urethra and to instil about 2 ounces of saline into the bladder.

(3) I often use No. 1 silk for the fixation sutures only in preference to catgut, particularly in obese subjects. In these bad cases it is necessary to be sure that the fixation will hold firm for longer than can be expected with catgut. There is no danger of sepsis from the use of an unabsorbable suture as (1) there is no knot protruding on the vaginal surface and (2) the silk on tying at fixation is pulled through the epithelium of the vaginal wall and is completely buried after a few hours.

(4) In Stage 3 it is advisable to use a strong half-circle round bodied needle (No. 2) which can be firmly held by a Swift-Jolly needle holder for the placing of the fixation sutures at the back of the pubic bone.

(5) In Stage 3, if one avoids placing the needle too near the under surface of the pubic arch in the region of the anterior cul-de-sac of the ischio-rectal fossa, where the pudendal vessels terminate, and of course the region of the obturator canal, which is well out to the side, there should not be untoward bleeding caused by the needle. On each side the needle point should emerge within ½ to ¾ inch from the urethra. In this way the uplift will be straight from below upwards. If the fixation needle emerges too far laterally, there will be an upward and lateral drag on the bolstered vaginal wall. This will give an inferior uplift and moreover tend to separate the colporrhaphy catgut sutures in the vaginal wall.

If some oozing occurs on the one side during fixation it is better to leave it until the other side is fixed. The resultant uniform compression by the uplifted vaginal plate will then control both sides.

(6) In the last 25 cases I have drained the pelvic floor on each side of the urethra by a thin rubber dam. These two drains deal adequately with any sero-haemorrhagic discharge from the fixation area and can be removed on the 3rd or 4th day.

It should really be enough in my opinion if a good hold be obtained on each side by one fixation suture only. I have always used two however on each side because of the uncertainty of getting a good grip with one of them, particularly in those cases where the pubo-rectalis is thin or torn. This state of affairs must be expected in the majority of cases. In such cases, therefore, a good grip of what muscle there is by the fixation mattress and an uplift of it along the line of its fibres, followed by fixation at its origin, can be the only method of shortening and replacing it in its original position that could be effective with this traumatized material. The support supplied below it by the bolstered vaginal plate, however, takes a good deal of this strain and enables the plicated muscle to form a new attachment to its origin.

Further, in remembering the relatively poor tissues with which one has to work, one should not be surprised to find some degree of retrogression in the result after a lapse of time. In this, however, I have been pleasantly surprised and attribute the permanence of the result to (1) the firmness of the original healing and (2) the degree to which elevation of the upper urethra can be affected by the modified colporrhaphy.

(7) Although the time factor possibly plays a part I consider that a posterior colporrhaphy should always be carried out at the same operation whenever there is rectocele or perineal laxity. Firmness of the lower fibres of the pubo-rectalis and the perineal muscles is essential to the maintenance of tone when this group undergo general relaxation on straining or micturition.

At the end of the operation, inspection of the vagina shows the degree of uplift of the lower half of the anterior vaginal wall. This at first appears rather firm and rigid, but after some months the normal appearance is established and the vaginal wall is pliable. The vital factor in this appearance is the reproduction of the transverse vaginal sulcus (described by Wilfred Shaw). I believe that this is due in the normal case to the tonal effects of the pubo-rectalis and its offshoots which form contact with the antero-lateral aspect of the anterior vagina wall, and under aspect of the upper urethra at this level. It has been very interesting to see how this transverse vaginal sulcus continues to maintain itself after the passage of time.

(8) Thanks to the elevation of the upper fixed point and the cure of the cystocele by the colporrhaphy, and the absence of undue vaginal distortion by the fixation, the operation by modified colporrhaphy is not followed by bladder atony and consequent residual urine with its evil effects. The Malecot catheter is however left *in situ* for 3 days to facilitate immediate post-operative drainage. Thereafter bladder function is resumed normally.

Combined Operations

It is quite feasible where necessary to combine modified colporrhaphy with laparotomy or vaginal hysterectomy without altering the position of the patient.

On two occasions abdominal hysterectomy for multiple small fibroids causing menorrhagia and on one occasion vaginal hysterectomy for the same lesion were carried out in conjunction with modified colporrhaphy.

Two of the younger patients (Mrs. V., age 35, and Mrs. W., age 37) became pregnant 1 year after modified colporrhaphy and were delivered by Caesarean section subsequently.

Complications following 76 cases carried out to date have been slight. In 4 cases which showed an anatomical and symptomatic cure at 4 months a return of bladder symptoms akin to urgency and pseudo-stress incontinence occurred at about 12 months. In 2 of these a degree of vaginitis and urethritis was found and in 2 others trigonitis was seen at cystoscopy. These cases subsequently settled on general and local treatment in a few days.

The Second Colporrhaphy Control Series

A further series of 14 cases has been carried out with the following result.

Before Operation (Colporrhaphy)

In 3 cases the upper urethra showed rotational descent and entered the urethro-vesical junction below the horizontal level—Type C(2) or (3).

After Operation (at 4 months)

In 1 case the upper urethra was lifted from 40° below the horizontal level to 30° above the horizontal level and a short P.U.V. angle was formed. The whole length of the urethra however remained abnormally inclined to the horizontal on straining—Type AB. A good result, but will this urethra stand the effects of strain over a length of time?—a guarded cure.

In 1 case the upper urethra was lifted from 10° below to 35° above horizontal on straining. A short but good P.U.V. angle was obtained: Type A(2). A good result.

In 1 case the colporrhaphy failed to change the cystogram picture which conformed to Type C(3). Anatomical failure.

This shows 2 cures in 3 cases which conformed to Type C(2) and (3). In both of these cures, however, the upper urethra still inclined to below 45° to the perpendicular on straining.

In 5 cases of this colporrhaphy control series the cystogram picture conformed to Type B(1) or (2).

Case 1—Type B(1) showed no change at 4 months after colporrhaphy. Anatomical failure.

Case 2—Type B(2) showed some uplift of distal urethra, but none of the upper urethra or change in P.U.V. angle. Anatomical failure.

Case 3—Type B(2) showed uplift of distal urethra but not of upper urethra, which remained inclined to the horizontal. Anatomical failure.

Case 4—Type B(2) showed no change. Anatomical failure.

Case 5—Type B(1) showed some elevation of the distal urethra but the upper urethra remained inclined to below 45° to the perpendicular. There was a short P.U.V. angle restoration however. Anatomical cure.

This shows only 1 cure in 5 cases of this type.

As I have said above it is probable in these cases that the actual pubo-rectalis and its muscular offshoots to the under aspect of the upper urethra are heavily traumatized. By colporrhaphy alone therefore the muscle tissue available is probably inadequate to effect uplift by bolster at the upper urethra level. It is also noted—as has been said before—that some of the severest cases of stress incontinence from the clinical aspect are of this type, Type B(2).

Further in this colporrhaphy control series there were 6 cases which conformed to Type A in some degree.

Case 1—Type A(2).

This is 1 of 2 cases in which I have found that after colporrhaphy a worse cystogram picture was produced.

Before operation the upper urethra was well elevated and inclined to 45° to the perpendicular. The P.U.V. angle was normal and was at the level of the lower edge femur. After operation (7 months) the upper urethra had descended (on straining) to the horizontal level and entered the U.V.J. at just above this level. Stress incontinence was not complained of either before or after operation, so that the symptom itself cannot be said to have been produced by colporrhaphy in this case. The cystogram, however, shows a definite change for the worse and raised in my mind the possibility that the lateral drag exerted by the bolster has in effect torn off remnants of the supero-lateral supports which had been just adequate in this case to maintain urethral elevation. I would say that the stress incontinence is likely to occur sooner or later in this case. Anatomical failure.

Case 2—Type A(2): showed a further uplift and a good angle. Good result.

Case 3—Type A(2): the upper urethra which entered at the horizontal level with some cystocele was elevated to 45° above horizontal, and a short P.U.V. angle produced. Good result.

Case 4—Type A(2): the upper urethra was elevated from 25° above horizontal with cystocele to 45° above horizontal. A good P.U.V. angle was maintained. Good result.

Case 5—Type A(2): the upper urethra was elevated from 15° above horizontal with short P.U.V. angle to 45° above horizontal with the same short P.U.V. angle. Good result.

Case 6—Type A(2): the whole urethra elevated to 40° from the perpendicular with a good P.U.V. angle was unchanged by colporrhaphy. No change.

Thus there were 6 cases in this colporrhaphy control series which conformed to Type A and in which there were no complaints of stress incontinence.

In these, 4 showed a good result from the colporrhaphy—1 showed no change, and 1 unfortunately showed an anatomical change for the worse.

To sum up this second colporrhaphy control series of 14 cases: in 8 cases (6 with stress incontinence) with a positive cystogram, there were 3 symptomatic cures in conjunction with anatomical cures which however showed good improvement but not perfect cystograms. The improvement was to the AB or A(2) type.

In 6 cases with no stress incontinence and a

normal type of cystogram, 4 showed a good anatomical result, 1 showed no change and 1 showed a change for the worse.

In 14 cases therefore 7 showed improvement. Six showed no improvement and 1 showed disimprovement in the cystogram as the result of colporrhaphy.

This conforms to the colporrhaphy control series of Part I in which, of the 10 cases (9 with stress incontinence) with abnormal cystograms, there were 4 symptomatic and anatomical cures and, in 10 cases of normal type, the majority showed further anatomical improvement.

Taking these two control series together, therefore, it would appear that in the 18 cases (15 with stress incontinence) with an abnormal cystogram, colporrhaphy alone can only effect a definite cure in 7 of these and one is impressed by its relative failure in those cases where the cystogram corresponds to Type B(2). As one would expect there was a general improvement shown in all cases corresponding to Type A(2). Contrary to my previous assertion in Part I, however, to the effect that colporrhaphy can never disimprove the cystogram, I must now record 1 case of Type A(2) and 1 case of Type B(1) in which this unfortunately has occurred. I still believe that secondary infection with imperfect healing and cicatrization is most likely to bring this about but cannot rule out the possibility of operative trauma to already devitalized tissues.

The Two-year Colporrhaphy Control Series

A series of 20 cases is now completed, in which a cystogram was carried out before and at approximately 4 months after colporrhaphy and also again after the lapse of about 2 years. In this way the effect of a more prolonged strain on the colporrhaphy and urethral bolster can be estimated.

In this series of 20 cases there were 11 cases with a normal Type A cystogram and no stress incontinence—5 of which showed a definite improvement, 5 showed no change, 1 showed some disimprovement—this case conformed to Type B(1).

Six cases with a straight elevated urethra but with loss of P.U.V. angle on straining—Type B—and stress incontinence.

Table I
New Colporrhaphy Control Series
(at 4 months)
14 Cases

Pre-operative Type		Number	4-month X-ray follow-up	Anatomical Result	Remarks
Normal	C(3)	1	C(3)	1 Fail	5 Anatomical
	C(2)	2	AB and A(2)	2 Good	failures in
	B(1)	1	AB	1 Good	8 Abnormal types
	B(1)	1	B(1)	1 Fail	
	B(2)	3	B(2)	3 Fail	
Abnormal	A(2)	4	A(1)	Good	1 Disimprovement
	A(1)	1	A(2)	No change	4 Improvements in
	A(2)	1	C(1)	Fail	6 Normal types

Table II
Old and New Colporrhaphy
(at 4 months)
Control Series

Old Series	=	4 cures in 10 Abnormal cases
New Series	=	3 cures in 8 Abnormal cases
Total	=	7 cures in 18 Abnormal cases

These anatomical cures are to A(2) or AB level

In these there was 1 symptomatic and probable anatomical cure to Type AB and 5 failures. Three of these showed deterioration after initial improvement. Three cases showed downward rotational descent of the upper urethra on straining whereby it entered the urethro-vesical junction below the horizontal level.

In 1 of these cases there was no stress incontinence and in the other 2 stress incontinence was only slight and intermittent. Two cases showed an improvement from Type C(2) to Type C(1) at 4 months and maintained at 2 years, and 1 other case showed a further slight improvement at 2 years to Type A(2).

This I feel may be due to a slow return of tone in the intrinsic muscle at the U.V.J. in these cases in which it was not entirely lost prior to operation.

I have however listed these 3 cases as anatomical cures in spite of the fact that the whole urethra including the upper urethra remains still abnormally inclined away from the perpendicular—in each of them about 70°–75° slant. The body strain therefore is across the transverse axis, which does not represent the best result. In one case the transitional Type AB was produced.

In the 20 cases of this 2-year colporrhaphy series therefore the chief symptomatic ones are those corresponding to Type B—as indeed I find in my other series. In these 6 there is only 1 cure —which again corresponds to the 4-month follow-up series.

In 3 of these cases a noticeable deterioration in the picture can be observed as the result of the passage of time, and this I relate to the fact that the intrinsic muscle tone at the U.V.J. was largely lost before operation. In this type of case therefore the bolster support must be inadequate and the result must be liable to deterioration as time goes on.

It will be seen that all but one of the anatomical cures in both the 4-month and 2-year series reach only the AB or A(2) type.

The New Modified Colporrhaphy Series

X-ray at 4 to 12 Months

In Part I the modified colporrhaphy series of 35 cases was reported. In these a follow-up cystogram at 4 months had been done. This showed that of the 35 cases there were 32 symptomatic and anatomical cures at that stage.

Since then I have carried out the modified colporrhaphy in a further 43 cases, thus bringing the total to 78. Of these cases 38 have had a follow-up cystogram at from 4 to 12 months. I am reporting these results in the more detailed form based on the types of cystogram previously described.

It will be seen that 38 cases showed 36 symptomatic cures and 35 anatomical cures.

The 35 anatomical cures reached Type A(1) in 26 cases; Type A(2) in 4 cases; Type AB in 5 cases (probable cures).

The 3 anatomical failures showed improve-

Table III
Colporrhaphy Control Series
(at 2 years)
20 Cases

	Pre-operative Type	Number	X-ray 4 months	X-ray 2 years	Result	Remarks
Normal	A(1)	1	A(1)	A(1)	Good	Hernia of Trigone cured
	A(2)	2	A(1)	A(1)	Good	Good
	A(2)	7	A(2)	A(2)	No change	No change
	A(2)	1	A(2)	A(2)	Disimproved	Deterioration
Abnormal	B(1)	3	A(2)	B(1)	No change	Deterioration
	B(1)	1	B(1)	B(1)	No change	No change
	B(1)	1	C(3)	C(3)	Disimproved	Disimproved
	B	1	AB	A(1)	Cure	Cure
	C(2)	2	C(1)	A(2)	Cure	Improved
	C(2)	1	C(1)	AB	Cure	Improved

ment from Type B(2) to B(1) in 2 cases and from Type C(3) to B(2) in 1 case.

From the further experience of the 2-year follow up it might be said that there were 30 perfect cures with 5 probable permanent cures and 3 failures. Two of the failures complained of stress incontinence, which however was relatively slight.

No. 1 silk was used in approximately half of these cases for the fixation sutures and No. 2 chromic catgut for the other half.

The point of interest is to note that the anatomical cure was brought about in this large number of cases by a return to the normal A(1) type of cystogram picture—a fact which is not paralleled by the colporrhaphy control series.

It is also interesting to note that this A(1) result was obtained in 11 of the 17 pre-operative B(2) types—the type which was so resistant to colporrhaphy alone.

I have felt that the nearer to this A(1) type the 4-month result is, the more likely is the 2-year result to be satisfactory, because one must allow in all cases for some slackening after a length of time due to continued strain on indifferent tissues.

In the total series of 78 cases 20 had previously been operated upon by colporrhaphy. Thus the immediate result continues to be satisfactory and particularly so when one considers that all these cases represent severe stress incontinence in association with a bad picture.

The 2-Year Modified Colporrhaphy Follow Up

In this 2-year follow up series there are 35 cases—all of Types B or C.

The result shows:

33 symptomatic cures
33 anatomical cures (4 probables)
2 anatomical failures.

Thus there was some return of symptoms in 2 of these cases—but to a milder degree.

Table IV
New Modified Colporrhaphy Series
38 Cases
Cystogram at 4–12 months

Pre-operative Type	Number	Cystogram at 4–12 months	Result	Remarks
B(1)	2	A(1)	Cure	Good Result
B(2)	11	A(1)	Cure	Good Result
B(2)	1	A(2)	Cure	Good Result, but not perfect
B(2)	3	AB	Cure	Good Result, but not perfect
B(2)	2	B(1)	Fail	Improved, but not to Type A
C(1)	3	A(1)	Cure	Good Result
C(1)	2	A(2)	Cure	U.U. still at 45
C(2)	3	A(1)	Cure	Good Result
C(2)	1	AB	Cure	Short P.U.V. angle
C(3)	7	A(1)	Cure	Good Result
C(3)	1	B(2)	Fail	Still elevated, but P.U.V. angle not restored
C(3)	1	AB	Cure	Short P.U.V. angle
C(3)	1	A(2)	Cure	P.U.V. angle normal, but U.U. too low

Table V
Old and New Modified Colporrhaphy Series
at 4–6 months

Old Series —35 cases show	32	Cures
New Series—38 cases show	36	Symptomatic Cures
	30	Perfect Anatomical Cures
	5	Probable Anatomical Cures (Type AB)
Total	73 cases show 67 cures	

The 33 anatomical cures conformed to:

Type A(1) after 2 years in 23 cases.

Type A(2) in 6 cases (4 of these latter cases had deteriorated from Type A(1) at 4 months).

The other 4 probable anatomical cures conformed to Type AB at 2 years.

The 2 failures showed some improvement from Types C(3) and B(2) to Types B(2) and B(1) respectively.

Thus one might say that there were 29 perfect results and 4 probable permanent results after 2 years in these 33 cases.

It is interesting to compare these results with those of the new colporrhaphy control series in which—in the 4-month series—there were 8 cases of primary B or C type. The 3 cures produced a cystogram picture conforming to Types A(2) and AB only.

In the 2-year colporrhaphy control series—there were 9 cases of a primary B or C type. The 4 cures produced a cystogram picture which also conformed to Type A(2) in 2 cases and AB in 1 case.

Thus it would appear that colporrhaphy with bolster can effect a symptomatic and anatomical cure of prolapse with the stress incontinence factor: in 7 out of 17 cases or—if the control series of Part I can be included—in 11 out of 27 cases—in which the cystogram picture conforms to the presence of it, but only, it would seem, by improving that picture to a stage where the upper urethra is still inclined to or below 45° to the perpendicular on straining in nearly all cases. Moreover, colporrhaphy is seen to be particularly inadequate in those cases which conform to Type B(2) where there is paralysis of the intrinsic musculature at the U.V.J. owing to lack of inferior muscle support to the upper urethra. In these cases the bolster will often fail to replace this support at a high enough level.

Complicated Cases

The modified colporrhaphy has been combined with abdominal hysterectomy for small fibroids in 2 cases; vaginal hysterectomy for small fibroids in 1 case, and laparotomy for dermoid cyst in 1 case.

In 5 cases at follow up some degree of urgency combined with a minor degree of stress incontinence has been noted. In 2 of these the symptoms were found to be due to cystourethritis secondary to *Trichomonas vaginalis* infection, and in 3 cases trigonitis was diagnosed by cystoscopy. The former cleared up on antibiotic treatment, and the latter responded to instillations of half per cent watery mercurochrome solution.

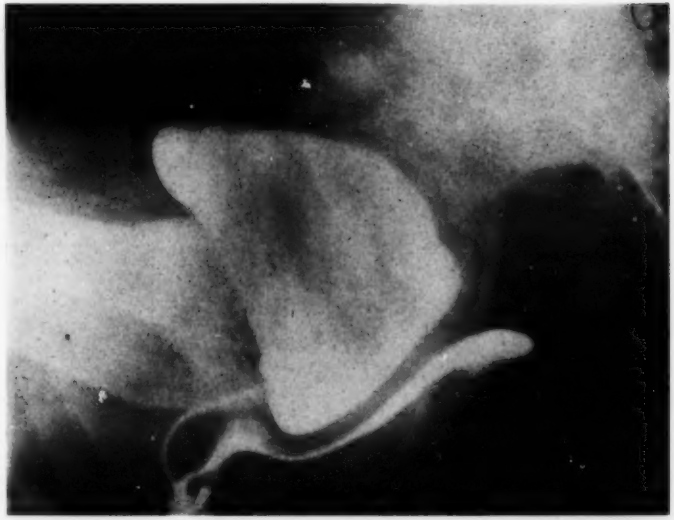
In one case only has a collection occurred in the Cave of Retzius. This was in the case of Mrs. F. (Case 182). At the 4-month follow up a cystic mass was palpable above the symphysis. Incision showed this to contain about 2 ounces of clear serous and sterile fluid. This case was not drained at operation, but subsequently I decided to drain the Cave of Retzius by a thin rubber dam for 3 days in all cases.

Table VI
Modified Colporrhaphy Series
2-year follow up

35 cases (C and B Types) show	33 Symptomatic Cures										
	29 Anatomical Cures										
	4 Probable Anatomical Cures (Type AB)										
	2 Failures										
23 A Cures	showed	Type A(1)	at	4	months	and	Type A(1)	at	2	years
5 A Cures	,,	Type A(1)	,,	,,	,,	,,	Type A(2)	,,	,,	,,
1 A Cure	,,	Type AB	,,	,,	,,	,,	Type A(2)	,,	,,	,,
2 A Cures	,,	Type AB	,,	,,	,,	,,	Type AB	,,	,,	,,
1 A Cure	,,	Type B(1)	,,	,,	,,	,,	Type AB	,,	,,	,,
1 A Cure	,,	Type A(1)	,,	,,	,,	,,	Type AB	,,	,,	,,
1 A Failure	,,	Type B(1)	,,	,,	,,	,,	Type B(1)	,,	,,	,,
1 A Failure	,,	Type B(1)	,,	,,	,,	,,	Type B(2)	,,	,,	,,

NORMAL STRAINING FILMS—TYPE A

Type A(1)



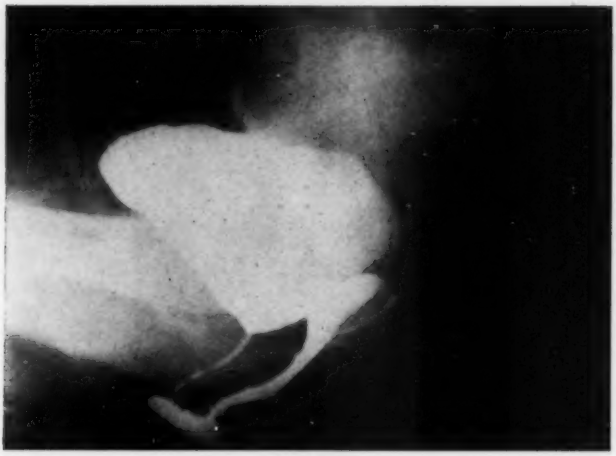
Type A(2)

FIG. 1

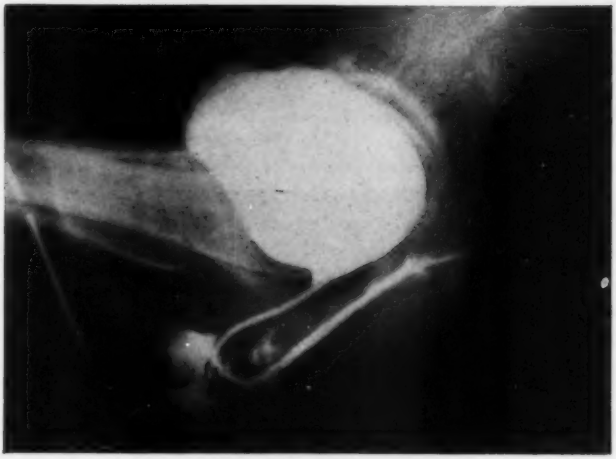
Type A(1).—Normal angle of U.U. (upper urethra) inclination.
Normal P.U.V. angle.
No stress incontinence. (Murray.)

Type A(2).—U.U. inclined to 45° or more from perpendicular.
Normal P.U.V. angle.
U.U. enters U.V.J. above horizontal. Slightly weak supports.
No stress incontinence. (Hankinson.)

TYPE B



Type B(1)



Type B(2)

FIG. 2

Type B(1).—Straight elevated urethra.
Impaired P.U.V. angle to about 140°.
Weak inferior supports.
Slight or no stress incontinence. (Heap.)

Type B(2).—Straight elevated urethra.
P.U.V. angle entirely lost.
Paralyzed inferior supports.
Loss of transverse vaginal sulcus.
Marked stress incontinence. (Johnson.)

K.V.B.

TYPE C

Type C(1)

Type C(2)

FIG. 3

Type C(1).—Marked rotational descent of U.U.—with Type A.
U.U. enters at or near horizontal.
P.U.V. angle normal or impaired.
Weak upper supports.
No stress incontinence. (Cliffe.)

Type C(2).—Pronounced rotational descent of U.U.—with Type B(1).
U.U. enters below horizontal.
P.U.V. angle impaired.
Further weakening of upper supports.
Slight or no stress incontinence. (Hatton.)

TYPE C—*Continued*

Type C(3)

FIG. 3—*Continued*

Type C(3).—Gross rotational descent with collapse of U.U.—with Type B(2).
P.U.V. angle entirely lost.
Loss or paralysis of upper and inferior supports.
Marked stress incontinence. (Dale.)

TYPE AB

FIG. 4

Type AB.—Early.—The urethra remains straight.
P.U.V. angle normal but short.
Weak inferior supports.
No stress incontinence. (Curran.)

K.V.B.

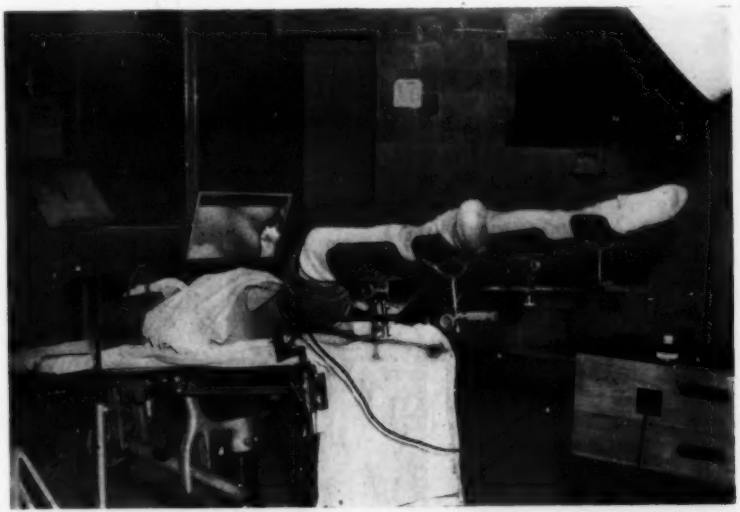
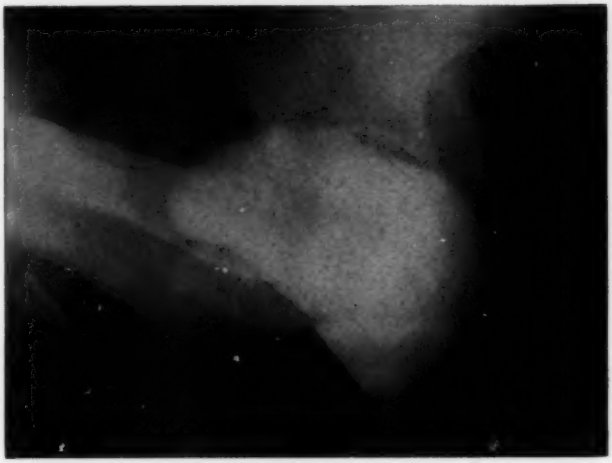


FIG. 5

Lithotomy-Trendelburg Position.
Patient in position.
Scyalitic light to assist colporrhaphy.
Diathermy.
Reflecting mirror to assist view of pelvic floor.
Undraped.

FIG. 6

Reflecting mirror wheeled into position to assist in placing of fixation sutures.



(*a*)

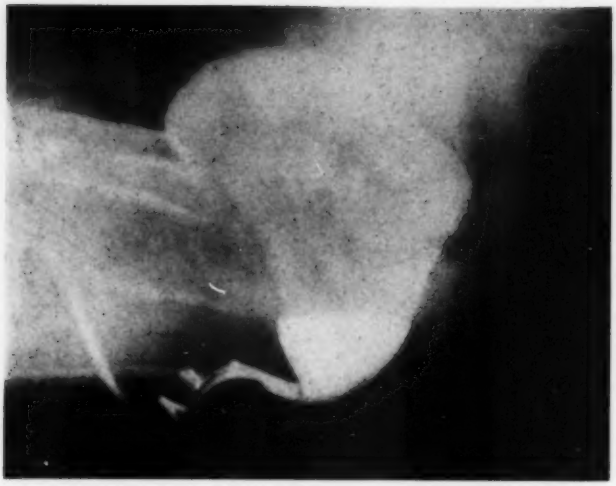
(*b*)

FIG. 7

Transverse vaginal sulcus restored by successful modified colporrhaphy.

(*a*) Pre-operative.

(*b*) Result at 2 years—T.V.S. well shown. (Brimelow.)



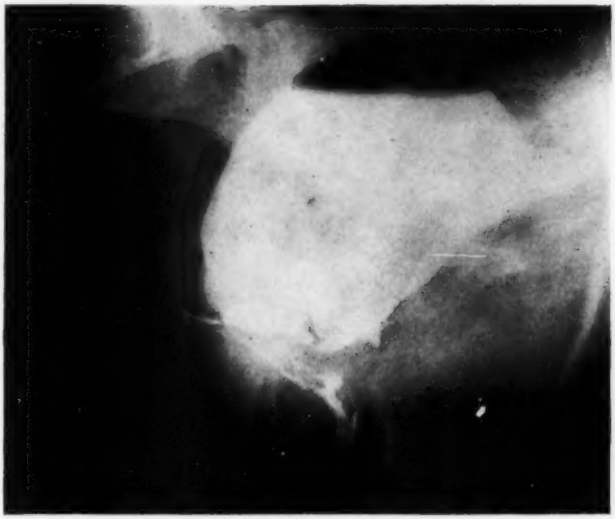
(*a*)

(*b*)

FIG. 8

Colporrhaphy results—at 4–6 months.
Failure with colporrhaphy from Type C(3) to Type B(2).
(*a*) Pre-operative—Type C(3).
(*b*) Urethra elevated but P.U.V. angle still lost.
T.V.S. not restored. (Powell.)

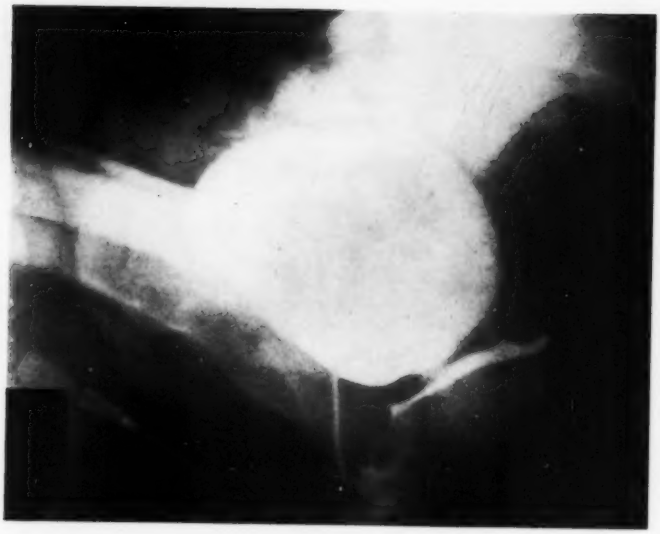
(*a*)



(*b*)

FIG. 9

Modified Colporrhaphy Result at 2 years.
Cure from Type B(2) to Type A(1).
(*a*) Pre-operative—Type B(2).
(*b*) At 4 months—Type A(2). (Breeze.)



(*c*)

FIG. 9—*Continued*
(*c*) At 2 years—Type A(1)—Perfect T.V.S. (Breeze.)

The Return of Intrinsic Tone at the U.V.J.

I have often been pleasantly surprised by the normal type of film which has resulted from the operation of modified colporrhaphy. At the 4-month follow up, when an A(1) straining film is produced from a primary C or B type, it has been difficult to believe that this normal P.U.V. angle results from the pressure of tissue actually placed behind the upper urethra at operation. Indeed I do not believe this to be the case. The technique of the operation results in the raising of the upper urethra infero-laterally on each side by the plico-fixation of the pubo-rectalis and its elevation on the upper surface of a bolstered area of vaginal wall. My view has always been that the re-establishment of the normal elevation, and the tissue contact infero-laterally produces conditions which facilitate a return of tonal contactility to the intrinsic musculature of the U.V.J.

It is for this reason, also, that colporrhaphy alone cannot be expected to produce a perfect cure in the worst cases—which show cystograms conforming to Type B(2) and Type C(3)—as sufficient elevation and contact cannot be secured to overcome the paralysis at this point.

This is mentioned as a possibility only, and it could be offset by those few cases which have shown a degree of deterioration in the film after a lapse of time. In these it might be said that the healing was imperfect enough to allow further lack of contact in the sub-urethral zone with resultant recurrent intrinsic atony. Only if the healing is good therefore, and the contact maintained can further improvement in these early part cures be expected. In this respect I have always been surprised that there are not more deteriorations than have been found in view of the causative trauma and poor tissues resulting from it—indifferent material in many cases for plastic repair.

Summary

In this presentation I have endeavoured to complete the description of the clinical aspects of uterine prolapse with stress incontinence and its treatment by modified Manchester colporrhaphy, which I began in Part I published in this Journal in June 1953.

Throughout I have been guided and influenced by the physiological work of Malpas, Jeffcoate and Roberts, which I assessed to my own complete satisfaction in Part I and which has continued to demonstrate its constancy throughout my series. Indeed I would say that the successful results accruing from the modified colporrhaphy—being itself a clinical application based on the dicta enunciated by them—proves without doubt the accuracy of their original findings.

In this communication therefore the main matters touched upon are:

(1) An application of the anatomical factors (as I believe them) concerned in the physiology of the urethra and bladder base in stress incontinence, to a more precise interpretation of cystogram findings. By this means the symptom, the degree of trauma, the assessment for operation and the results following operation can be more accurately determined.

(2) Further details with regard to the operative technique of the modified colporrhaphy are described.

(3) A number of follow up series are described:

(*a*) A new colporrhaphy control series of 14 cases at 4 months, which showed 3 cures in 8 positive stress incontinence cases.

Added to the colporrhaphy control series in Part I—there is a total of 7 cures in 18 cases.

(*b*) A colporrhaphy control series of 20 cases—at 2 years, which showed 4 cures in 9 positive stress incontinence cases.

(*c*) A new modified colporrhaphy result series—at 4 months. In this 38 abnormal cases showed 36 symptomatic and 35 anatomical cures.

Twenty-six of the 35 anatomical cures reached the A(1) type.

(*d*) A modified colporrhaphy result series—at 2 years. In this 33 abnormal cases showed 31 symptomatic and 31 anatomical cures.

Twenty-one of the 31 anatomical cures reached the A(1) type.

(4) Conclusions to be drawn from these follow up studies are:

(*a*) The Manchester colporrhaphy alone by its inability to sufficiently re-establish the

anatomical situation in the worst cases is unsuitable for such cases in so far as the cure of the stress incontinence factor is concerned.

(*b*) These bad cases are those in which a cystogram conforming to Type B(2) and Type C(3) is found.

(*c*) The modified Manchester colporrhaphy gives a high cure rate over 2 years in all, including the worst cases, and thus should be the operation indicated particularly for Type B(2) and Type C(3)—which are clinically the most severe and operatively the most resistant.

(5) The important matter, therefore, is the choice of case. At the Out-Patients Clinic approximately one-third of all cases of uterine prolapse will complain to some extent of stress incontinence. Of these approximately one-third will give positive clinical tests and show negative results to investigation for other causes. These should be submitted to cystogram and the type of film assessed. Having further regard to the age and general condition of the patient, and the degree to which the symptom is affecting her nervous and physical state, either colporrhaphy or modified colporrhaphy is indicated.

In my view—as stated above—colporrhaphy alone is adequate for all cases with the definite exception of those showing a cystogram conforming to Type B(2) and Type C(3).

(6) Finally, I would wish to emphasize the necessity for the recognition of stress incontinence as a clinical entity, which sometimes requires special operative treatment, and the need therefore for investigation of all suspected cases.

Again I wish to express my thanks and appreciation to all those who have helped in the preparation of this work. As is well known, such a clinical investigation demands team work by all concerned. I should again like to thank particularly Dr. Hartley and Miss Fisher of the X-ray Department for their constant and valuable assistance, and the excellence of their technical work, which has been widely admired. My thanks also to my Registrars, Drs. Grayburn and Norburn and House Surgeons, Drs. Kramer, Feinstein and Ostolosky, for their diligent and enthusiastic work. The photography is chiefly by the Department of Medical Illustration at the Manchester Royal Infirmary, and other preparations by my Laboratory Steward, Mr. F. Dale—for which I am much indebted.

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CHRONIC HYPERTENSION FOLLOWING PRE-ECLAMPTIC TOXAEMIA
THE INFLUENCE OF FAMILIAL HYPERTENSION ON ITS CAUSATION

BY

F. J. BROWNE, M.D., D.Sc., F.R.C.S.E., F.R.C.O.G.

AND

D. R. SHEUMACK, M.B., M.R.C.O.G.

From the Royal Hospital for Women, Sydney, Australia

IT has long been known that in a certain proportion of women who have had pre-eclamptic toxaemia or eclampsia the hypertension from which they suffered during the pregnancy as one of the manifestations of the disease persists permanently. The proportion of patients so affected, of course, varies according to the standard of hypertension adopted. If this is "over 130 systolic and 70 diastolic" approximately 50 per cent develop chronic hypertension, while with a standard of "over 140/90", respectively, about 20 per cent develop it (Browne and Dodds, 1939).

If, however, the blood pressures of a large group of parous and nulliparous women, say 1,000 of each, are examined, it is found that the average blood pressures in the parous women are not any higher than those in the nulliparae in the various age groups (Isenhour, Kuder and Dill, 1942; Barnes and Browne, 1945). (Tables I and II.)

Yet, if pre-eclamptic toxaemia or eclampsia cause chronic hypertension, and as a certain proportion of parous women must have suffered from these diseases, one would have expected the incidence of chronic hypertension to have been higher in the parous group.

In this connexion it should be recalled that Theobald in 1933 contended that neither pre-eclamptic toxaemia nor eclampsia caused chronic hypertension because on examination of the Registrar General Returns for England and Wales he found that the death rates from cardiovascular disease were not any higher amongst parous than nulliparous women, or indeed among males of the same age groups.

TABLE I

Mean Blood Pressures in All Age Groups

Age Group	Total	Systolic Blood Pressure (mm. Hg)		Diastolic Blood Pressure (mm. Hg)	
		Mean	S.D.*	Mean	S.D.*
10 to 19:					
Nulliparous	82	119·4	11·0	76·3	9·6
Parous ..	3	109·0	49·6	69·0	4·9
20 to 29:					
Nulliparous	401	119·3	15·7	76·2	11·3
Parous ..	208	121·8	14·1	77·4	10·8
30 to 39:					
Nulliparous	274	126·9	15·5	78·5	12·3
Parous ..	364	126·0	15·0	79·0	13·2
40 to 49:					
Nulliparous	105	134·9	19·3	85·0	12·1
Parous ..	275	134·7	22·3	85·5	13·0
Over 50:					
Nulliparous	53	152·7	30·9	91·6	17·0
Parous ..	191	155·1	30·7	93·2	16·0

* Standard deviation.

It seemed to us that a possible explanation might be that pre-eclamptic toxaemia and eclampsia do not *cause* chronic hypertension, but simply make it appear earlier in women with a familial hypertensive tendency, and who would have developed it even if they had never become

TABLE II
Patients with Blood Pressure Over 120/80 and Over 140/90

Age Group	Total	Blood Pressure over 120/80		Blood Pressure over 140/90	
		Total	Per cent	Total	Per cent
10 to 20:					
Nulliparous ..	82	23	28·0	0	0
Parous ..	3	1	33·3	0	0
20 to 29:					
Nulliparous ..	401	101	25·2	16	4·0
Parous ..	208	64	30·7	9	4·3
30 to 39:					
Nulliparous ..	274	117	42·7	23	8·4
Parous ..	364	133	36·6	27	7·4
40 to 49:					
Nulliparous ..	105	61	58·0	20	19·0
Parous ..	275	162	59·0	58	21·1
Over 50:					
Nulliparous ..	53	38	71·7	21	39·6
Parous ..	191	151	79·0	91	47·7

pregnant, but possibly at a later age. In other words, pre-eclamptic toxaemia may unmask a latent and familial hypertension.

If this explanation were correct, examination of the parents and siblings of patients who had had pre-eclamptic toxaemia should show a higher incidence of chronic hypertension in the families of women who developed chronic hypertension than in the families of those who did not. It might indeed be found that only patients who had a familial hypertensive background were liable to develop chronic hypertension after delivery.

INVESTIGATION

In order to test this hypothesis all primiparae who had had pre-eclamptic toxaemia in the Royal Hospital for Women, Sydney, and who were being followed up in the toxaemia clinic, were asked to co-operate in getting their parents and brothers and sisters to report for blood pressure examination. The investigation has been in progress for over 3 years, yet though the Royal Hospital for Women has approximately 3,000 deliveries yearly only 100 families have been examined. This is because: (1) only primiparae were accepted for inclusion, as in multiparae the histories of previous pregnancies were usually too vague for classification, or they had been confined elsewhere; (2) the patient must have been seen and examined before the end of the 20th week counted from the first day of the last menstrual period in order that the variety of toxaemia should be classifiable; (3) her relations must be accessible for examination. The relatives of many lived too far away or in other states or countries, especially as Australia has now a large migrant population.

RESULTS

The 100 patients under review had 433 blood relatives—parents, brothers or sisters. Of these 39 were dead, and 14 were either unknown, lived abroad, or in another state, or could not be traced. The total number of relatives, therefore, who could reasonably be expected to report was 380. Of these 82·9 per cent attended for blood pressure recording. Of all the 433 relatives the percentage examined was 72·7. Of the 200 parents, 35 were dead, 6 were "unknown", and 8 failed to report without any excuse. The number who reported was therefore 151 (75·5 per cent).

Two standards of hypertension were adopted for patients and relatives, namely "over 120/80" and "over 140/90".

(A) STANDARD "OVER 120/80"

The number of patients with residual hypertension, when the adopted standard was "over 120/80", was 49 (49 per cent), while 90 of the 100 families had one or more hypertensive members.

The incidence of residual hypertension in patients with hypertensive relatives was 48 in 90 families (53·3 per cent).

The incidence of residual hypertension in patients none of whose relatives had hypertension was 1 in 10 families (10 per cent).

The value of Chi-square is 5·6 which corresponds to a probability between 0·01 and 0·02. This is significant at the 5 per cent level.

(B) STANDARD "OVER 140/90"

When the adopted standard was "over 140/90" the number of families with 1 or more

hypertensive members was 68, and the number of patients with residual hypertension was 12 (12 per cent).

The incidence of residual hypertension in patients from hypertensive families was 10 in 68 families (14·7 per cent).

The incidence of residual hypertension in patients from non-hypertensive families was 2 in 32 families (6·2 per cent).

It will be evident that the number of "hypertensive" families shown in both the "over 120/80" and the "over 140/90" groups must be the minimum as only 72·7 per cent of relatives attended for blood pressure recording. If all had been examined some of those families now classed as non-hypertensive might have been included in the hypertensive group. Thus both parents of one of the 2 patients with residual hypertension in "non-hypertensive" families in the "over 140/90" group had died from cardiovascular disease. The mother of the other patient had died of disease of the gall bladder and the father from coronary occlusion. If these 2 families are included in the hypertensive group, as they probably would have been had the parents been alive, it would mean that all the patients with residual hypertension came from hypertensive families, while, amongst the families without any hypertensive member, no patient who had had pre-eclamptic toxaemia developed residual hypertension. The value of Chi-square in this case is 5·3 corresponding to a probability between 0·02 and 0·05 which is again significant at the 5 per cent level.

If, as is assumed, the occurrence of toxaemia makes a latent hypertension appear at an earlier age than it would otherwise have done, it might be expected that the chronic hypertension so caused would significantly increase the mean systolic and diastolic blood pressures in the younger groups of parous as compared with non-parous women. It should, however, be recalled that only about 6 per cent of previously normal pregnant women develop pre-eclamptic toxaemia, and that of those who do so, only 20 to 50 per cent, depending on whether the standard of hypertension adopted is "over 140/90" or "over 120/80" respectively, become chronic hypertensives immediately after delivery. Of 1,000 women therefore, only from 14 to 30 would develop chronic hypertension following pre-eclamptic toxaemia, numbers which would be overshadowed, even swamped, by the much larger number who would not be influenced.

Summary

(1) As a result of examining the blood pressures of parents and siblings of 100 primiparae who had pre-eclamptic toxaemia and were followed up in the postnatal clinic, there seems to be sufficient evidence to suggest that those who belong to hypertensive families run a certain risk of developing residual hypertension immediately following the pregnancy in question.

(2) On the other hand, the evidence suggests that if the patient with pre-eclamptic toxaemia does not belong to a hypertensive family she will not develop residual hypertension.

(3) It is probable that in patients who develop chronic hypertension the pre-eclamptic toxaemia does not *cause* the hypertension but simply unmasks a familial tendency to hypertension and makes it develop earlier than it would otherwise have done.

We wish to thank Professor C. Scott Russell, Professor of Obstetrics and Gynaecology, University of Sheffield, England, for kindly assessing the statistical significance of our results; to Sister Joan Robinson, and to the Medical Superintendent of the Royal Hospital for Women, Dr. John Greenwell, for much help; to Drs. David Howell, Ian Cope, Ralph Forman, R. G. Harbison and Enid Carey, House Surgeons, for help in rounding up families and taking blood pressures at odd hours.

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POST-ECLAMPTIC VEGETABLISM

BY

C. W. F. BURNETT, M.D., F.R.C.S., F.R.C.O.G.
Obstetrician and Gynaecologist
West Middlesex Hospital

THE introduction of modern methods of treatment for eclampsia has led to two beneficial results; firstly the maternal mortality rate from this disease has been significantly reduced, and secondly the lives of gravely ill patients with fulminant eclampsia have been saved. A study of the post-eclamptic behaviour of these patients has rarely been possible before, and may be expected to throw some light upon the essential pathology of this disease. A case of this nature has recently been under my care, and as the sequelae of the eclamptic attack were most unusual, they are thought to be worthy of publication.

CASE REPORT

Mrs. M.M., a multipara aged 26, who had had one previous child, was delivered of twins, a male weighing 6 pounds 11 ounces (3,034 g.) and a female weighing 5 pounds 7 ounces (2,467 g.) at 3.40 a.m. and 3.48 a.m. in a private nursing home on 18th March, 1955. Her pregnancy and delivery were thought to have been normal, but following the birth she complained of severe headache and vomited frequently. At 6.15 p.m. she had an eclamptic fit. Her blood pressure was then taken and was found to be 200/114 mm. Hg. She was given morphia gr. ¼ and further medical advice was sought. During the next 30 minutes she remained comatose, having frequent, recurring fits. She became deeply cyanosed in spite of the administration of oxygen by tube and funnel, and developed frothing at the mouth, dilated pupils, and a pulse rate varying between 120 and 172 per minute. When the Flying Squad arrived at 6.45 p.m. she was seen in this condition having by then had about 20 fits; she was found to be grossly oedematous with a pulse rate of 172 and a blood pressure of 180/115 mm. Hg.

Immediate treatment with Veratrone was begun, according to the technique described by Stern and Burnett (1954), and this resulted in a fall of blood pressure to 90/40 and the cessation of fits. Oxygen was given by a BLB mask and the cyanosis was gradually relieved. At 8.45 p.m. she was transferred to the West Middlesex Hospital, but on arrival there another 20 fits occurred between 9.15 p.m. and 9.50 p.m. Further Veratrone was administered and was continued throughout the night whilst she remained in coma, the blood pressure being prevented from rising above 150/100 mm. Hg. With this treatment she had no further fits, having had a total number of about 60. She was incontinent of urine, and had noisy respirations due to pulmonary oedema for which atropine was given.

March 19th. At 3 a.m. she became cyanosed with stertorous breathing, despite oxygen therapy, and at 3.55 a.m. she collapsed but improved with artificial respiration. She later remained comatose throughout the day, Veratrone being repeated when necessary to prevent a rise of blood pressure. The cyanosis had now passed, but her pulse rate remained 120 to 130 per minute. A 5 per cent intravenous dextrose drip was set up, the adventitious sounds having disappeared from the lungs, and she was given procaine penicillin 600,000 units twice daily. She remained incontinent of urine, but on catheterization 6 ounces (170 ml.) of urine were obtained, containing 3 g. of albumen per litre. In the evening it was noticed that her oedema was less, and she began to respond to stimuli by moving her limbs and head, and giving an occasional groan. The optic fundi showed papilloedema but no haemorrhages or exudates.

March 20th. Her condition was changed but little. At 4.25 a.m. she appeared to be nearing consciousness, the pupils being dilated and equal, and the tendon reflexes brisk. Babinski responses were present. The blood pressure was still controlled by Veratrone and the pulse rate varied between 80 and 100. In the evening she was still unconscious, but her pupils showed a slight light reflex. She now held her arms flexed, but was noticed to be moving her limbs a little with some spastic restriction to passive movement. There was no neck rigidity. Periods of Cheyne-Stokes respiration were present. The incontinence had ceased, and on catheterization 36 ounces (1,023 ml.) of urine were obtained, containing 2 g. of albumen per litre.

March 21st. The coma became less deep; she opened her mouth when requested, and moved her arms and legs in response to supra-orbital pressure. The blood pressure ranged between 152/118 and 128/90, the pulse rate 70 and 90, the oedema had lessened, and a Babinski response persisted only on the right side. Adequate amounts of urine were obtained *vid* an indwelling Foley's catheter (1 g. of albumen per litre) and she was incontinent of faeces.

March 22nd. The coma now appeared lighter, and the

response to supra-orbital pressure was more marked. At 1.30 p.m. her blood pressure rose to 160/130 and the Veratrone was repeated. The urine was now free of albumen, and the oedema had disappeared. The blood chemistry now showed:

Blood urea	19 mg. per cent.
Blood sugar	75 mg. per cent.
Serum Chlorides	630 mg. per cent = 107 m.eq. per litre.
Serum Sodium	344 mg. per cent = 149 m.eq. per litre.
Serum Potassium	18·3 mg. per cent = 4·7 m.eq. per litre.
Alkali reserve	45 vols. CO_2 per cent = 20·5 m.eq. per litre.

The blood picture was:

Hb. 11·9 g.	80 per cent.
Haematocrit	39 per cent.
Mean Cell Haemoglobin concentration	30·5 per cent.
White Blood Cells	6,000 per c.mm.
Neutrophiles	78 per cent.
Lymphocytes	19 per cent.

March 23rd. Her condition remained unchanged. Lumbar puncture yielded normal fluid under normal pressure. At 9.15 p.m. the blood pressure rose to 200/144 necessitating further repetition of Veratrone. This was the last time Veratrone was given, for after this the blood pressure remained fairly constant at about 136/96. A total dosage of 73 minims (4·3 ml.) of Veratrone was given during the 6 days. The pulse rate hereafter remained steady at about 80. The temperature was normal throughout.

March 24th. In the course of this day she had tonic extensor spastic attacks, during which she extended both arms and legs and developed neck rigidity. At these times she appeared more alert and conscious of her surroundings, but after each attack she reverted to her comatose state. In the evening she showed more awareness of her surroundings; her vision had returned, as evidenced by protective blinking when an object was brought near to her face, and she now kept her eyes opened for long periods. She also followed the nurses' movements with her eyes, but would not respond to simple commands like "open your mouth". For the first time she swallowed spoonfuls of water when placed in her mouth. The intravenous drip was now discontinued as the needle was dislodged by her movements.

She thus emerged gradually from her state of coma on the evening of the seventh day. At first the periods of consciousness were intermittent with intervening lapses into coma, but gradually they became longer until she was fully conscious.

March 25th. Oral feeding was now begun and gradually increased during the following days. Her condition improved, and she attempted to raise herself in the bed. During these days she developed writhing, athetoid movements of the arms and legs. She ate and drank when food was placed in her mouth, but she neither spoke nor made purposeful movements.

By 29th March she had a thin, drawn face, anxious appearance, prominent malar bones and supraorbital ridges, and a malar flush. She had a gross loss of subcutaneous fat, an inelastic skin and matchstick limbs. Mentally she resembled a frightened animal, moving, almost cringing and slithering, to the opposite side of the bed when approached. She uttered expiratory grunts, but no recognizable words. The spasticity had now disappeared and the central nervous system, urine and blood chemistry were normal.

At postnatal examination on 30th March the pelvis appeared normal. The breasts were soft, and no lactation occurred at any time throughout the whole of the puerperium.

During the next few days she remained in this condition, moaning continuously and unable to recognize her husband and friends. She ate moderately well but could not feed herself.

On 3rd April the Foley's catheter was removed, and she was able to use the bed-pan; occasionally accidents occurred when spontaneous micturition and defaecation took place into the bed.

On 5th April she was lifted out of bed and sat in a chair for 20 minutes; from this beginning she progressed to full ambulation, until on 12th April she was able to walk without support, and to climb stairs with assistance.

She had now reached a vegetative state. Unable to understand external happenings, she could feed herself with her fingers but not with cutlery, and she was able to sleep, use a bed-pan and make incoherent noises. She showed no emotional reaction to her husband and babies, but occasionally she bit members of the nursing staff if they did something of which she disapproved.

The question now arose of discharging her from the maternity unit. After much negotiation she was transferred to Springfield Hospital, Upper Tooting. I am indebted to Dr. H. C. Beccle, the Physician Superintendent, for an account of her subsequent progress. After her admission there she contracted a severe urinary infection with *Bacterium coli communis* and *Bacterium alkaligenes*; at first this responded to treatment, but later it recurred and she developed hyperpyrexia with a temperature of 106° and had some epileptiform seizures. Despite the administration of penicillin, chloromycetin, and streptomycin, she died on 29th April, the 43rd day after delivery.

Post-mortem Findings

A post-mortem examination was carried out by Dr. D. Haler at the Coroner's request, and he has kindly informed me that he found evidence of pyelitis with toxic parenchymatous changes in the kidneys, a raised hyaline area in the uterus resembling a placental polypus, attached to the endometrium, and extensive bilateral, symmetrical, post-Rolandic areas of cerebral softening. Dr. R. H. Boardman of Springfield Hospital has amplified this description of the brain, stating that the parasagittal areas of softening were about 1½ inches in diameter, and appeared identical on the two

sides. The centres were necrotic and emptied when cut, the solid rims of the cavities being white in colour but heavily speckled with dark red haemorrhagic spots 1 to 2 mm. in diameter.

Dr. Boardman was able to procure some portions of the brain and uterus for further study. I was able to interest Dr. L. Crome, neuropathologist of the Fountain Hospital, Tooting Grove, in this material, which he kindly examined and reported on as follows:

(1) THE BRAIN

Pathological Findings

"The fragment of brain included cortical tissue and underlying white matter, but no indication of its more precise site of origin was available. It showed, on naked eye examination, numerous small haemorrhages in an area of about 0·3 cm. in diameter situated in the white and, to a smaller extent, in the grey matter.

"This material was embedded in paraffin and sections stained with haematoxylin and eosin, haematoxylin and Van Gieson, phospho-tungstic acid haematoxylin, and the Holzer method for fibrous glia. Myelin was stained by the Kulschitsky-Pal method and frozen sections were also treated by the Herxheimer method for fat and the Holzer method.

"The subarachnoid space contained a moderate number of histiocytic mononuclear cells with oval or horse-shoe shaped nuclei and basophilic cytoplasm (Fig. 1). Some arteries in the subarachnoid space showed fibrinoid necrosis and were partially thrombosed (Fig. 2). Coagulated plasma surrounded several of these vessels, and a network of fibrinous threads was visible in phospho-tungstic acid haematoxylin preparations. The haemorrhagic area within the brain substance showed likewise fibrinoid degeneration of arterioles with partial thrombosis and exudation of plasma and erythrocytes. Capillaries were dilated and many contained hyaline thrombi. A completely necrotic focus was also seen in one area, having no surviving cells other than a few polymorphonuclear leucocytes. Some arteries showed, in addition to the fibrinoid necrosis (Fig. 3), mural infiltration with polymorphs. Many of the nerve cells throughout the haemorrhagic area had completely disappeared; others were in various stages of severe degeneration. The haemorrhages were of different duration; some with well-preserved red blood cells were of very recent ante-mortem origin; partial coagulation and lysis were present in others.

"Nerve cells in the non-haemorrhagic parts of the material showed fairly uniform shrinkage (Fig. 4); their nuclei were pyknotic with indistinguishable nucleoli, and cytoplasm elongated into tortuous processes. Much oedema with hydropic degeneration of cells was present in the immediate vicinity of the haemorrhagic zone.

"A small amount of neutral fat was seen in many of the capillary endothelial cells, both in the non-haemorrhagic and the haemorrhagic areas, and in the latter there were also some extra-cellular globules of fat. Sections stained by the Kulschitsky-Pal method showed considerable breakdown of myelin in the haemorrhagic area. In other places there were beading and 'varicosities' of myelin fibres."

Survey of the Literature

Although patients with post-eclamptic psychosis and aphasia have been frequently described, only 2 similar cases of a vegetative existence following severe eclampsia appear in the literature. Lowenberg and Lossman (1943) reported a patient with eclampsia in whom the blood pressure rose to 200/90 mm. Hg before delivery, which was followed one hour later by almost continuous uncontrollable convulsive attacks lasting for 14 hours. Coma persisted for 60 hours, and 35 hours later the patient opened her eyes, occasionally moved her limbs and swallowed liquids, but was unable to talk or recognize relatives. During the following months she swallowed food which was placed in her mouth, and followed moving objects with her eyes, but she made few spontaneous movements, and uttered only occasional unintelligible sounds. She died after 6 years of a vegetative existence.

Josephy and Hirsch (1946) described a patient who had 5 intra-partum eclamptic fits, followed by almost continuous post-partum convulsions lasting for 45 minutes. After recovery she never regained her normal mentality, but lived a vegetative form of life being fed by a stomach tube and having occasional convulsions. At the

FIG. 2

Fibrinoid necrosis of arteries in subarachnoid space and cortex. The meningeal vessel is surrounded by coagulated plasma. P.T.A.H. ×95.

FIG. 1

Cellular exudate in subarachnoid space. H.E. ×180.

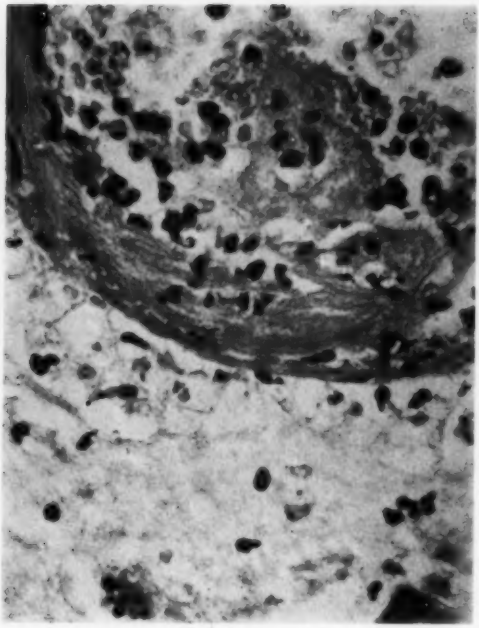

FIG. 3
Fibrinoid necrosis of cortical artery. H E. ×550.

FIG. 4
Shrinkage of nerve cells. H.E. ×125.

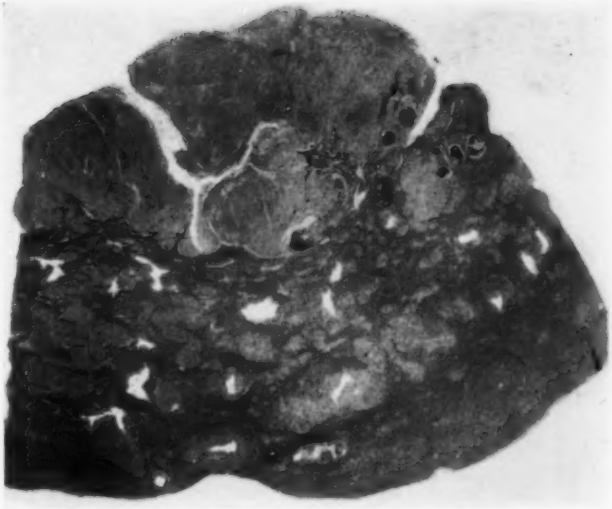

FIG. 5
Necrotic tissue in uterus. H.E. ×3.

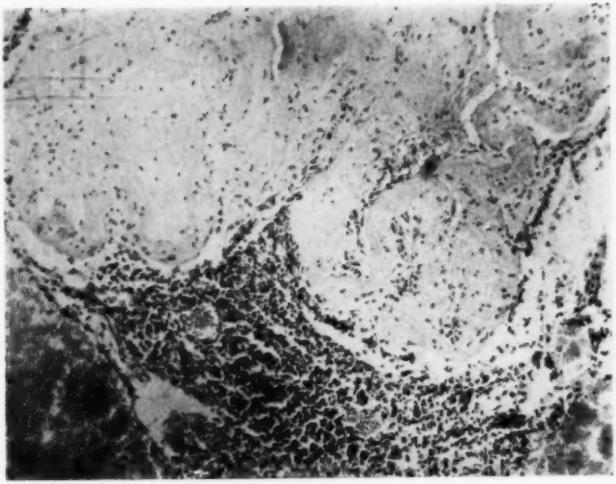

FIG. 6
Junction of necrotic tissue and endometrial stroma. H.E. ×95.

end of the puerperium a ventriculogram revealed an atrophic cerebrum and dilated ventricles. She died 3 months and 2 days after delivery.

Discussion

It is clear that the vegetative mode of existence following eclampsia is a very rare phenomenon compared to the post-eclamptic psychosis, characterized by stupor, disorientation, confusion, and hallucinations, which is seen much more frequently. In the 3 cases described the vegetative state had been preceded by a period of almost continuous fits, which had occurred post-partum. Such severe eclamptics as these patients rarely survive, and this no doubt explains the rarity of the vegetablism syndrome.

It might be expected that post-mortem examination of these patients' brains would reveal some causal pathological lesions common to all 3 cases which would be attributable to the antecedent eclampsia. Dr. Crome has reviewed these cerebral changes and sends me the following note:

"Owing to the incomplete pathological examination it is impossible to reach definite conclusions regarding the nature of the pathogenetic process in this case. The most conspicuous changes in the brain were vascular; fibrinoid necrosis of some of the arteries, extravasation of plasma and blood cells, as well as frank haemorrhage. The shrinkage and degeneration of nerve cells in other areas is a non-specific change consistent with anoxia. It is known to occur in hypertensive encephalopathy of varying aetiology.

"It is also difficult to relate these findings to those in the two previously reported cases of post-eclamptic encephalopathy.

"In the case described by Lowenberg and Lossman the brain showed marked atrophy, weighing only 579 g. This atrophy was particularly marked in the frontal, temporal and parietal lobes. Cystic degeneration was seen in the coronal blocks affecting mainly the white matter. Demyelination was present in the atrophic areas. Histological study showed considerable loss of parenchyma—myelin and nerve cells—in the affected areas. Degeneration was most marked in the white matter, particularly near its junction with the cortex. There was also some degeneration in the basal ganglia and cerebellum, and the meninges were greatly thickened. Blood vessels showed no special change.

"In the case reported by Josephy and Hirsch there was a partially organized subdural haematoma. The cortex was narrow and a thin layer of degenerated tissue was present between it and the white matter. Histological examination showed marked destructive changes in the cortex with loss of nerve cells and fibres. There was softening with partial organization in one area. Glial cells were increased in number. Degeneration was also particularly marked in the more superficial parts of the white matter. Some of the Purkinje cells and cells in the dentate nucleus had disappeared in the cerebellum. There was enormous dilatation of capillaries and small veins. The authors characterized their findings as a destructive process of the cortex with organization, and demyelination of the centrum semi-ovale. They thought that these changes represented an early stage of lesions similar to those reported by Lowenberg and Lossman.

"Fibrinoid vascular necrosis and its possible relation to hypertension have not been mentioned in either of the two reports, but it is possible, of course, that all traces of this early stage of the disease had disappeared before the fatal termination. Cystic degeneration in one of the above cases and the reported softening in the other are similar to the findings in the present case, and this similarity extends also to the bilateral symmetrical nature of the lesions."

Unfortunately no definite conclusions can be reached on the basis of this evidence. Lowenberg and Lossman considered that the cerebral lesions in their case were due to a toxin rather than to arteriolar spasm—this was because the damage occurred largely in the upper zones of white matter, a region of the brain known to have a poor vascular supply. Moreover known toxic conditions, such as Wilson's disease and fatal nitrous oxide poisoning, cause similar changes in these areas. Josephy and Hirsch, however, thought the lesions were brought about by vascular changes, namely vasoparalysis and venous thrombosis with subsequent anoxaemia. The present case suggests that vascular spasm with resulting anoxia is the true

aetiological agent, and that the whole process is simply one of hypertensive encephalopathy induced by the eclampsia, the structural damage to the brain being responsible for the prolonged coma and rapid succession of fits rather than the eclamptic process itself.

(2) The Uterus

The hyaline tissue attached to the uterine wall is also not without interest. Although the patient showed no signs or symptoms of retained products or puerperal sepsis, this structure was at first thought to be an infected placental polypus. However, on examination of the section Dr. Crome states:

"A layer of necrotic hyalinized material measuring up to 1 cm. in thickness formed the innermost layer of the uterus (Fig. 5). The precise origin of this tissue was no longer identifiable, but some of its contours were suggestive of a plexus of dilated blood vessels. There was no inflammatory reaction in or around it. The subjoining endometrium (Fig. 6) consisted chiefly of stroma with few epithelial cells. These stromal cells were directly contiguous with the necrotic layer. Many of the blood vessels in the myometrium were enlarged and hyalinized.

"The histological features of uterine involution were described by Shaw (1929). His material included the uterus of a primipara who died from puerperal insanity 6 weeks after an uncomplicated labour at term. The endometrium had undergone complete involution and was typical of the normal resting phase. The vessels of the myometrium stood out prominently. The placental site was identifiable by the remains of the sinuses. These consisted of whorled and convoluted masses of hyaline tissue. A few of these masses of hyaline tissue were found in the endometrium.

"It would therefore seem that the histological material in the present case was also taken at the placental site and the hyaline layer of tissue represented the remains of sub-placental sinuses.

"It was also mentioned by Shaw that published descriptions of normal uterine involution are scarce and it is impossible therefore to be certain that the present case presents no abnormality of involution. Nothing in the material suggests, however, such uterine abnormality."

Conclusion

It may be concluded that the hypertension and prolonged anoxia that occur with severe eclampsia give rise to a hypertensive encephalopathy of profound degree, which, if the patient survives, produces areas of ischaemic necrosis in both the grey and white matter which destroy the higher cerebral centres. In consequence of this damage the patient is reduced to a vegetative form of existence, from which there is no recovery. There are no pathognomonic brain changes, but only those resulting from hypertension and anoxia. Such cases have in the past occurred extremely rarely as the severity of the eclamptic process which is necessary to produce such a severe encephalopathy has at the same time killed the patient; with the improved treatment of eclampsia by means of hypotensive drugs, and the salvage of patients who would have otherwise died, it may be expected that they will be encountered more frequently in the future. It is to be hoped, however, that this threatened increase will be cancelled by a decreased incidence of eclampsia itself, for it is no therapeutic achievement to save the life of a patient at the cost of her living a decerebrate existence. The horror of seeing a previously healthy woman suddenly reduced to a state of vegetablism certainly acts as a powerful incentive to exercise the most thorough antenatal care throughout pregnancy, and to give the most meticulous treatment to all patients suffering from pre-eclampsia.

Summary

(1) The clinical features are presented of a case of severe eclampsia progressing to a vegetative state which terminated fatally after 6 weeks.

(2) Two similar cases are described from the literature, and the histological features of the brains are compared.

(3) The nature of a hyaline structure attached to the uterine wall is also discussed.

Acknowledgments

My thanks are due to Mr. R. B. H. Wyatt, Her Majesty's Coroner for the Southern District, County of London, for permission to publish the post-mortem findings, to Dr. R. H.

Boardman, M.D., M.R.C.P., for his kindness in collecting post-mortem specimens for examination, and to Dr. L. Crome, M.R.C.P.Ed., for his expert examination, report and discussion. A special tribute must be paid to the Nursing Staff of the Queen Mary Maternity Unit, West Middlesex Hospital, whose unremitting zeal kept the patient alive for so long under most difficult circumstances.

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THE USE OF AN ION-EXCHANGE RESIN IN THE CONTROL OF PRE-ECLAMPSIA

BY

GERALD W. KORN, M.B., M.R.C.O.G.

Senior Registrar

Department of Obstetrics and Gynaecology, Whittington Hospital, Highgate

INTRODUCTION

THE ion-exchange resins were first introduced in the treatment of cardiac and renal disease as a method of reducing the accompanying oedema. More recently attention has been focussed on their use in the control of pre-eclampsia.

Pre-eclampsia is associated with a retention of sodium in the extracellular spaces.

Dieckmann (1950) has accentuated the signs of pre-eclampsia by the oral and intravenous administration of quantities of sodium chloride. Backer (1954), Carey (1952, 1953a, b), Dunster (1953, 1954), Hutchinson and Plentl (1954) and Odell, Janssen, Novelli and Ralston (1951), have attempted to show that the reduction of body sodium is followed by an improvement in the pre-eclampsia.

Before the extracellular sodium can be reduced it is necessary to reduce the amount of sodium ingested daily. This average figure of 10 g. of sodium chloride can be reduced to 2 g. daily by eliminating salt from cooking processes, by discontinuing its use as a table condiment and by removing salt-containing foods from the diet. Beyond this figure of 2 g. the food is largely unpalatable.

The ion-exchange resins have been introduced to reduce the quantity of sodium chloride absorbed below the figure of 2 g.

The resins are organic compounds which when suspended in solution of salts behave as electrolytes, an exchange of ions taking place.

Two types of resins have been synthesized, the cation-exchange resins which behave like acids and the anion-exchange resins which have the properties of bases; the latter are little used therapeutically.

The cation-exchange resins are sub-divided into 2 main groups: (*a*) the sulphonic resins and (*b*) the carboxylic variety. The latter act only at their full combining capacity at a pH of 14, whereas the former show affinity for cations at a pH of 3 or above.

The cation preparations available are usually mixtures of ammonium and potassium resins.

As the resin reaches the gastric juice ammonium chloride is formed and this is absorbed. In the small intestine the resin combines with the sodium present in high concentration according to the simple equation:

$$K \text{ (or } NH_4\text{) resin} + Na\,Cl = K \text{ (or } NH_4\,Cl\text{)} + Na \text{ resin}$$

The sodium now combined with the resin passes out into the faeces.

The ammonium chloride formed in the stomach and small intestine is reabsorbed and produces an acidosis which is further responsible for sodium excretion for a period of 2 to 3 days. At the end of this time the production of ammonia by the kidney successfully competes with the sodium ions replacing them in the urine thus preventing further sodium excretion.

Backer (1954), Carey (1952, 1953a, b), Dunster, McGowan and Bennett (1954), Hutchinson and Plentl (1954), Odell, Janssen, Novelli and Ralston (1951), Willson (1949) and Willson and Penman (1950) have used the resins in small series of cases either as in-patients or out-patients. Most authors have only used the ion-exchange resins after the more orthodox management of pre-eclampsia seems to have failed. Comparative series of cases of pre-eclampsia treated by the orthodox method and by the use of ion-exchange resins have not been described so far. It was considered that the

effect, if any, of this compound could be demonstrated most effectively if two parallel series of cases of pre-eclampsia were treated by the standard methods and by the use of the resin.

Method

One hundred cases of pre-eclampsia were included in this investigation. Fifty of these received the standard treatment and 50 the ion-exchange resin in addition to the standard treatment. The selection of the control and resin series was by alternation only.

The criteria of pre-eclampsia were a persistent blood pressure of 130/90 mm. Hg or higher, appearing for the first time after the 26th week of pregnancy, associated with oedema or albuminuria.

On admission all patients in the resin and control series were placed at complete rest in bed. Twice daily blood-pressure readings were recorded. The fluid intake and urinary output were charted. Daily urine examinations were carried out.

A low salt diet was given to all cases but it was doubtful if further restriction below the figure of 2 g. daily could have been possible although Dunster (1953) was able to reduce her patients to an 0·8 g. diet. A fixed fluid intake of 2 pints (40 ounces) daily was given to each patient. The resin chosen was a mixture of ammonium and potassium polysterene sulphonate (Katonium, Bayer) and was given in doses of 25 g. 3 times daily for a period of 5 days followed by 3 days rest. This scheme closely follows that of Carey (1953a, b) who used a carboxylic cation-exchange resin. This course was repeated until the patient was discharged from hospital or until delivery.

Hutchinson and Plentl (1954) concluded that detailed biochemical investigations were unnecessary and consequently none were undertaken.

Results

Figure 1 presents in graphic form the progress of the blood pressure throughout the treatment.

The geometric mean of blood pressures, $\left(\frac{\text{the sum of the Log blood pressures}}{\text{No. of cases}}\right)$ has been calculated. This is preferred to the arithmetic

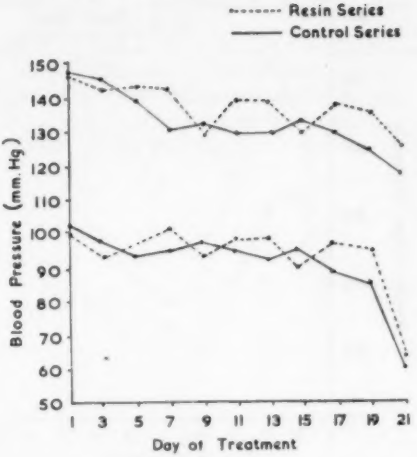

Fig. 1

Comparison of the levels of blood pressure in the Resin and Control series.

method of calculation because it reduces the influence of extremes of blood pressure on the mean. It can be seen that there is a similarity between the initial blood pressure in both series and hence an accurate comparison of the two series is possible. It can also be seen that the rate of fall of blood pressures in both series is identical.

Figure 2 presents the difference between the urinary output in both series. The geometric mean has again been calculated. The difference in output here is quite considerable. The output in the resin series rises on the 3rd, 5th and 7th days, falling gradually and finally paralleling that of the control group.

The disappearance of oedema closely followed the rise in the urinary output and the rate of disappearance was greater in the resin series.

The duration of the treatment varied considerably. Many patients responded to either regime and were discharged from hospital. In others, there was little or no response and induction of labour was carried out. In a third group labour commenced spontaneously whilst the treatment was in progress.

Figure 3 presents the number of cases remaining under treatment as time progressed

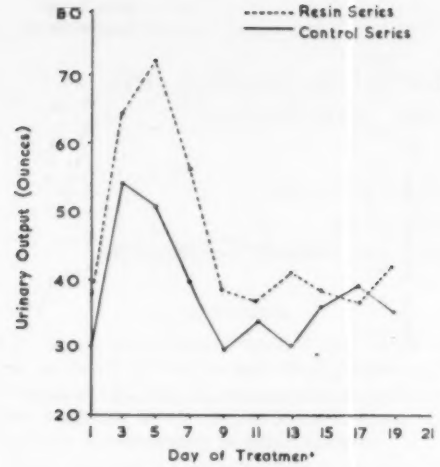

FIG. 2

Comparison of the urinary output in the Resin and Control series.

and again the similarity between the series can be seen indicating the lack of difference between the effect of the orthodox management of pre-eclampsia and the addition of the ion-exchange resins to this treatment.

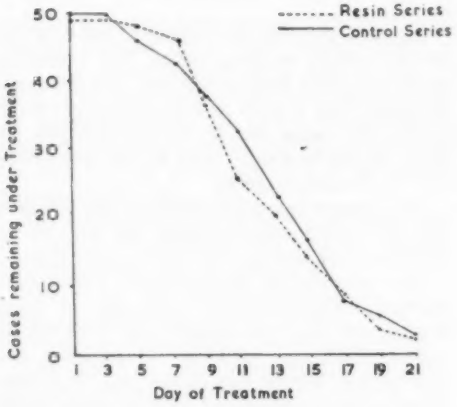

FIG. 3

Comparison of the number of cases remaining under treatment in the Resin and Control series.

Stillbirth Rate

There was 1 stillbirth in the control series and 4 in the resin series. Of these 1 was a hydrocephalic and 1 an anencephalic monster. The difference between these figures is not significant.

Maturity at Induction or at the Spontaneous Onset of Labour

Resin series (Geometric mean) 38 5/7 weeks.
Control series (Geometric mean) 38 4/7 weeks.

Birth Weight of All Cases

Resin series
(Geometric mean) 6 pounds 8 ounces.
Control series
(Geometric mean) 6 pounds 11 ounces.

SUMMARY AND CONCLUSIONS

(1) The comparative effects of treatment of pre-eclampsia by the orthodox methods and by the addition of an ion-exchange resin have been investigated.

(2) The greater increase of the urinary output in those treated by the resin series as compared with the control series has been demonstrated and it has been seen that the rate of disappearance of oedema follows the rise in the daily urinary output.

(3) There is no significant increase in the rate of fall of blood pressure in the resin series.

(4) The difference between the foetal loss in the resin and control series is not significant.

(5) The foetal maturity following induction or after spontaneous onset of labour shows little difference between the two series.

(6) The value of an ion-exchange resin has not been demonstrated in the treatment of pre-eclampsia.

ACKNOWLEDGMENT

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INACTIVATION OF OXYTOCIN AND VASOPRESSIN BY BLOOD PLASMA OF PREGNANT WOMEN

BY

S. E. DICKER, M.D., Ph.D., D.Sc.

AND

CHRISTINE TYLER, B.Sc., Ph.D.

From the Department of Pharmacology, University College, London

THE successful maintenance of pregnancy and the avoidance of premature delivery requires that the uterine muscle should remain relatively quiescent throughout gestation. Though it is doubtful whether neurohypophyseal hormones are circulating continuously, there is experimental evidence indicating that when they are secreted the amount of oxytocic activity is 15 to 20 times as great as that of the vasopressor activity (Abrahams and Pickford, 1954). It might be expected, therefore, that during pregnancy the response of the myometrium to a possible release of the oxytocic agent will be controlled.

Blood serum or plasma from pregnant women contains a so-called "enzyme" capable of inactivating oxytocin *in vitro* (Fekete, 1930; Werle, Hevelke and Buthmann, 1941; Page, 1946; Hawker, 1955). This "enzymic" activity, however, has not been found in blood plasma of pregnant rats, rabbits or guinea-pigs (Page, 1946). The purpose of the present investigation has been to make a quantitative evaluation of these inactivation processes. The effect of blood plasma of pregnant women on both the oxytocic and vasopressor activity of posterior pituitary extracts has been studied with a view to securing some information about its significance.

METHODS

Assays of oxytocic and vasopressor activity. For oxytocic assays, the isolated rat uterus preparation (Holton, 1948; Tyler, 1955) was used, immersed in a modified Ringer-Tyrode solution, without Mg^+ (de Jalon, Bayo and de Jalon, 1945). The temperature of the bath was kept at $29 \pm 0{\cdot}5°$ C. The sensitivity of the preparation allowed the estimation of 0·5 mU oxytocin, and was such that a four-fold increase of the dose of oxytocin (from 0·5 to 2·0 mU) produced more than a five-fold increase of the reaction (Fig. 1). Preliminary experiments had shown

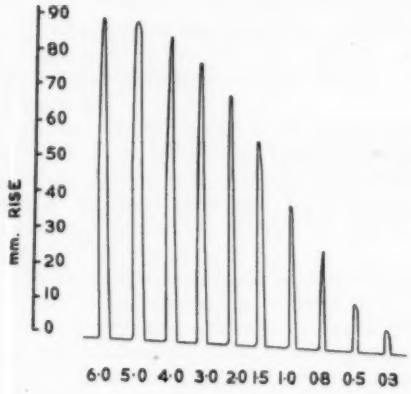

FIG. 1

Responses of rat uterus to graded doses of oxytocin. Abcissa: mU oxytocin.

that the addition of 0·1 ml. plasma, diluted 10 times with 0·9 per cent NaCl solution, was liable to sensitize the uterine preparation to subsequent doses of the standard solution of oxytocin. Consequently, instead of a (2 and 2) dose assay (Schild, 1942), the assays were carried out by "matching" contractions at two doses levels, each dose of the test solution being "bracketed" between two doses of a standard solution (Fig. 2). The error of the method was of the order of 20 per cent.

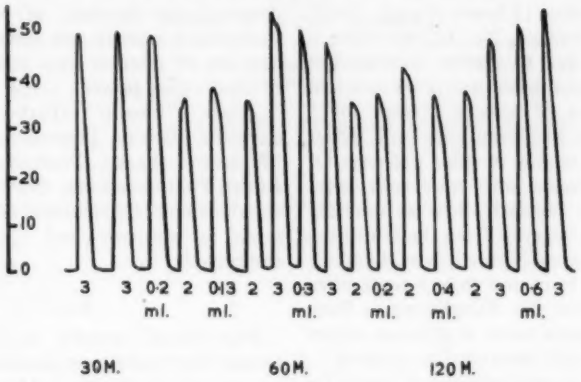

FIG. 2

Quantitative estimation of the power of plasma of a 4½-months pregnant woman (Table I, No. 3) to inactivate oxytocin. Figures without units=mU oxytocin; other figures=volume of mixture (plasma and oxytocin) added to bath. Length of incubation of plasma and oxytocin, at bottom. (For details of assay, see text.)

For the assays of the vasopressor activity, the rat blood pressure method was used (Landgrebe, Macaulay and Waring, 1946; Dicker and Tyler, 1953). A design of assay similar to that used for the oxytocic activity was followed; the error was of the same order of magnitude (Fig. 3).

Preparation of test solutions. One unit of oxytocin or of vasopressin was added to 0·2 ml. of plasma, which had been diluted tenfold with 0·9 per cent NaCl solution. The mixture was incubated at 37°±1° C. for known periods of time. Samples were taken at suitable intervals, plunged into boiling water for 3 minutes, and assayed after cooling.

Blood sampling. Thirty-eight samples (5–10 ml.) were investigated. They were taken from the antecubital vein into tubes containing heparin (10 units per ml. of blood), and the plasma was separated by centrifugation at 900×*g.* for 10 minutes.

Classification of subjects. The 26 subjects (2 controls, 22 pregnant women and 2 post-parturient women) investigated were all healthy young women, of an average age of 26 years (range: 22 to 36 years). Of the 22 obstetric cases, 17 were primigravidae and 4 multigravidae (parity 1 in 3 cases, and parity 3 in 1 case). Out of the 16 women seen at term or during the first stage of labour, 9 had normal labour with a

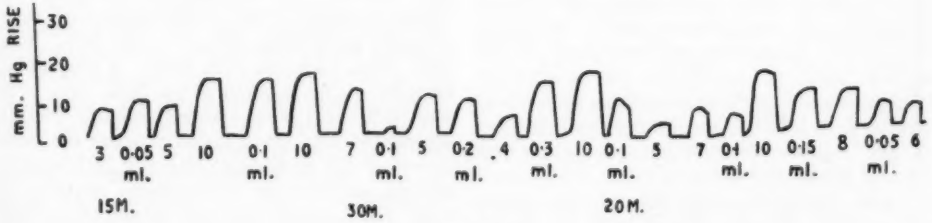

FIG. 3

Quantitative estimation of the power of plasma of a woman in first stage of labour (Table I, No. 18) to inactivate vasopressin. For interpretation, see Fig. 2 and text.

first stage not exceeding 15 hours (Young, 1943). In one case only (Table I, No. 16) was there a prolonged labour due to uterine inertia. The second stage of labour lasted nearly 3 hours and necessitated the use of forceps. Except for 5 women, all subjects were seen once only, either during pregnancy, labour or after delivery. Of the 5 pregnant women who were seen more often, 2 were seen regularly, first at monthly and then at weekly intervals from the 6th to the 9th month of pregnancy (Table I, Nos. 4 and 6), and 1 was seen at term and then a week after delivery (Table I, No. 16). Blood samples from 2 non-pregnant women taken at different stages of their menstrual cycle were used as controls.

Expression of results and definition of terms. To obtain a comparison of the results, the incubation time necessary to decrease the initial oxytocic or vasopressor activity by half was determined. This time is referred to as Ko or Kp (Figs. 4 and 5). Samples in which no demonstrable decrease of either oxytocic or vasopressor activity was observed after incubation for 60 minutes were considered as devoid of inactivating power.

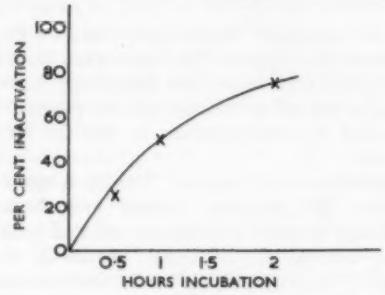

FIG. 4

Graphical representation of results of assays of Fig. 2.

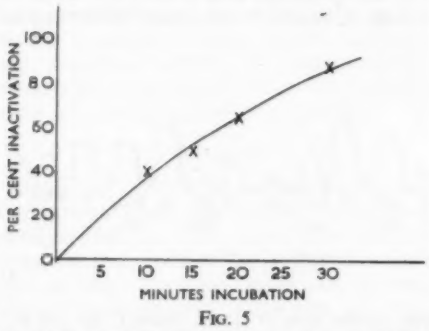

FIG. 5

Graphical representation of results of assays of Fig. 3.

Drugs. "Pitocin" (Parke, Davis & Co.; oxytocin, British Pharmacopoeia, 1953) and "Pitressin" (Parke, Davis & Co.; vasopressin, British Pharmacopoeia, 1953) were used for the standard and test solutions and were assayed in terms of oxytocic and vasopressor activity, respectively.

RESULTS

Five blood samples from 2 non-pregnant women (controls) were incubated with oxytocin or vasopressin (Table I, Nos. 1 and 2). In no case was there any decrease of either the oxytocic or vasopressor activity.

When plasma samples from 6 different pregnant women chosen at random (length of pregnancy ranging from 18 to 35 weeks) were incubated with oxytocin or vasopressin there was a significant decrease of both activities (Table I). The value of Ko (time required to decrease the initial amount of oxytocic activity by half) was 60 minutes in a woman at 18-weeks (Table I, No. 3) and 15 minutes in another woman at 30-weeks pregnancy (Table I, No. 7). The Kp (time required to decrease the initial amount of vasopressor activity by half) values were between 20 and 30 minutes.

The overall picture of an increase of the oxytocic inactivating power of plasma of pregnant women with duration of pregnancy was however only apparent. This could be demonstrated by testing samples of plasma from the same women taken at various intervals from the 26th week up to term (Table II, Nos. 4 and 6). Plasma samples of No. 4 were assayed for their oxytocic inactivating power at the 26th, 30th, 34th, 36th, 37th and 38th weeks of pregnancy. Samples of No. 6 taken at the 28th, 35th, 37th and 38th weeks, were assayed similarly. Plasma samples of both cases, tested at about the same period of the pregnancy (26th and 28th weeks), showed some ability to inactivate oxytocin *in vitro*. The values for Ko were 20 and 60 minutes for Nos. 4 and 6 respectively. However, in all other plasma samples taken from either case, after that period and up to full-term pregnancy,

TABLE I
Summary of All Cases Investigated

No.	Age	State	Parity	Inactivating Property of Plasma for:		Values of		Duration of Labour	
				Oxytocin	Vasopressin	Ko (minutes)	Kp (minutes)	1st Stage (hours)	2nd Stage (minutes)
1	27	Non-pregnant ..	0	0	0				
2	26	Non-pregnant ..	1	0	0				
		Pregnant:							
3	24	18 weeks	0	+	+	60	30		
4	24	26 weeks	0	+	+	20	30		
5	33	28 weeks	0	+	−	16	—		
6	27	28 weeks	1	+	+	60	20		
7	26	30 weeks	0	+	−	12	—	15	60
8	28	35 weeks	0	+	−	20	—	50	70
9	23	Full-term	0	+	+	15	30	24	15
10	30	Full-term	3	+	+	60	10	22	18
11	30	Full-term	0	0	+		10	10	45
12	24	Full-term	0	+	+	40	10	51	35
13	27	Full-term	0	0	+		10	21	30
14	22	Full-term	0	0	+		10	19	65
15	31	Full-term	0	0	−		—	4	60
4	24	Full-term	0	0	+		10	5	45
16	27	Full-term	0	+	−	5	—	18	175
17	29	Full-term	0	0	+		10	12	45
6	27	Full-term	1	0	+		10	4	10
18	25	1st stage labour ..	0	+	+	60	15	18	45
19	23	1st stage labour ..	0	0	+		15	15	60
20	23	1st stage labour ..	0	0	+		10	11	35
21	36	1st stage labour ..	1	0	+		10	4	50
22	25	1st stage labour ..	0	0	+		5	8	25
		Post-partum:							
16	27	7 days	1	0	+		60		
23	24	7 days	1	0	−		—		
24	28	7 days	1	0	−		—		

Non-pregnant (=controls) women were investigated 5 times.
Detailed information about Nos. 4, 5, 6 are in Table II.
For calculation of Ko and Kp, see text.

the factor that inactivated oxytocin had disappeared (Table II); this occurred quite independently of that responsible for the inactivation of vasopressin. Indeed, from the 35th to the 38th week there was a marked increase of the latter, with Kp values of 10 minutes (Table II).

The fact that there was no increase of the oxytocic inactivating power of plasma with the length of pregnancy, but that it disappeared altogether towards the end of pregnancy, was confirmed by the results obtained from a series of women examined at term. This series comprised 9 new cases and 2 (Nos. 4 and 6) seen previously. It will be seen (Table I) that out of the 11 plasma samples investigated, 7 proved to be without any action on oxytocin, though inactivating vasopressin to a considerable extent.

To this series can be added that of 5 women seen during the first stage of labour (Table I, Nos. 18–22), the plasma of 4 of whom had no action on oxytocin when incubated with it, though all samples had a marked activity on vasopressin, with Kp varying between 15 and 5 minutes.

TABLE II

Detailed Information About Two Cases

No.	Age	Length of Pregnancy in Weeks	Inactivating Property of Plasma:		Ko (minutes)	Kp (minutes)	Duration of Labour	
			Oxytocin	Vasopressin			1st Stage (hours)	2nd Stage (minutes)
4	24	26	+	+	20	30		
		30	0	+		20		
		34	0	+		20		
		36	0	+		10		
		37	0	+		10		
		38	0	+		7	5	45
6	27	28	+	+	60	20		
		35	0	+		10		
		37	0	+		10		
		38	0	+		10	4	10

These two women are the same as those referred in Table I, under the same reference number.

It was of interest to correlate the results found in women at term and during the first stage of labour with the duration of labour. With the exception of 2 cases (Table I, Nos. 13 and 14), all 9 women whose plasma had *no* oxytocic inactivating property had a short first stage of labour, with an average length of just over 8 hours (range 4 to 15 hours). In contrast, in the cases (Table I, Nos. 9, 10, 12, 16 and 18) where plasma exerted a marked inactivation of oxytocin, the first stage of labour was always prolonged. Its average duration was 26½ hours (range: 18 to 51 hours). This was specially noticeable in a woman who suffered from uterine inertia (Table I, No. 16) with a second stage of labour lasting about 3 hours. Her plasma was extremely active: 0·2 ml. of plasma inactivated 500 mU oxytocin in 5 minutes.

Finally, 3 women were examined 7 days after parturition. One of them (Table I, No. 16) had been investigated during labour and had been suffering from uterine inertia, the others were new cases. There was no evidence of oxytocic-inactivating property in any of the plasma samples examined, though some pressor inactivating property was still present in the plasma of No. 16.

DISCUSSION

Page's (1946) claim that "from the 4th to the 38th week after conception, there is a thousand-fold increase in the plasma pitocinase concentration, and this high level is maintained during labor" could not be confirmed. This difference in results needs some explanation. Page used the isolated rat uterus in a Tyrode's solution at 37° C. It is known that, when suspended in a bath containing magnesium salt or kept at a temperature of 37° C., the isolated uterine strip will exhibit spontaneous contractions which render the preparation unsuitable for quantitative estimations. This is in fact amply demonstrated by Page's own tracing, and is partly responsible for the fact that Page's preparations showed only a 2-fold increase in the height of the contractions for a 20-fold increase in the dose of oxytocin. Page varied the amount of plasma to be incubated from one experiment to another, with the result that, when the dilution was high, the component of the uterine contraction due to the non-specific action of the plasma was low; the ensuing small contraction could then mistakenly be attributed to a greater amount of oxytocin being inactivated. Finally, at the end of the incubation, Page added "one drop of a 10 per cent acetic acid" to the mixture of plasma and oxytocin before putting the tube in boiling water. The final concentration of acetic acid was not stated. It has been shown, however, that the addition of as little as 0·1 ml. of a 0·025 per cent acetic acid solution to the bath produced sensitization of the uterine preparation to further doses of standard which made it impossible to use it for a "matching" assay (Bentley and Dicker, 1955).

In the present investigation the rat uterus was

suspended in a modified Ringer solution poor in calcium and free of magnesium (de Jalon, Bayo and de Jalon, 1945) at 29±0·5° C. This reduced the spontaneous contractions and provided a preparation which gave a single contraction when stimulated by a dose of oxytocin. The sensitivity of the preparation gave a 5-fold increase of the contractions for a 4-fold increase of the dose of oxytocin. The initial amount of plasma and of oxytocin remained the same in all assays, so that a decrease of the uterine contractions was due to a decrease of the oxytocic activity only and not to a dilution of the plasma. Finally, no acetic acid was added to the mixture of plasma and oxytocin at the end of an incubation period, as there is no evidence that posterior pituitary extracts are bound by plasma (Heller and Urban, 1935; Dicker and Ginsburg, 1950). This was incidentally confirmed by the fact that no decrease of the oxytocic activity was observed when plasma of normal women, and of most of the pregnant women at term, was incubated with oxytocin.

It is clear that plasma samples taken from pregnant women possess the ability to inactivate to some degree both oxytocin and vasopressin in *in vitro* experiments. Though the ability to inactivate vasopressin was present in all blood samples examined from the 18th week of pregnancy up to and including the first stage of labour, the property for inactivating oxytocin was absent towards term in the majority of cases. It is of interest to note that plasma samples which had marked oxytocin inactivating power after the 30th week of pregnancy or at term were those of women who subsequently had a prolonged labour (Table I, Nos. 7, 8, 9, 10, 12 and 16): the plasma with the highest activity was that of a patient suffering from uterine inertia (Table I, No. 16). A simple and tempting explanation of these findings could be that in these cases there was "something" in the plasma which prevented the normal oxytocic action of the neurohypophyseal secretion. To illustrate the degree of activity of such plasma against oxytocin, it can be calculated, by interpolation from the curve of oxytocin inactivation, that in the case No. 16, 3·51 of the plasma (i.e., the plasma volume of a normal adult woman) would inactivate more than 8,500 units of oxytocin in 5 minutes.

It would thus appear that the pregnancy of a normal woman is protected by her own blood plasma against any abnormal secretion of oxytocin from the neurohypophysis, up to about the seventh month (Tables I and II); whereas towards the end of a normal pregnancy there would be nothing in the plasma to interfere with the physiological action of oxytocin on the gravid uterus. The plasma however would remain highly active against vasopressin (Fig. 6). Taking an average value for Kp (at term and

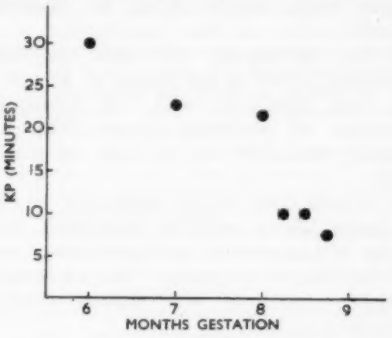

FIG. 6

Vasopressin-inactivating power of the plasma of one patient (Table II, No. 4). Blood samples taken at intervals, from 6-months gestation to term. Ordinate = Kp = incubation time necessary to decrease the initial vasopressor activity by half.

during the first stage of labour) of 12 minutes, this would indicate that the circulating plasma could inactivate about 3,500 units of pressor activity in 5 minutes. This, however, is difficult to understand as the urinary secretion would still have to be controlled by the antidiuretic hormone, unless it be assumed that the factor responsible for the inactivation of the pressor activity is selective, leaving the antidiuretic activity of the hormone unaffected. The question requires further investigation.

After delivery, plasma samples showed little activity against either oxytocin or vasopressin, thus allowing the neurohypophyseal hormones to play their role in the "let down" process of lactation unimpaired (Cross, 1951; Cross and van Dyke, 1953).

Summary

(1) Blood plasma samples of non-pregnant (control) and of pregnant women were incubated with oxytocin and vasopressin *in vitro*, at 37° C. for up to 2 hours. The ability of plasma to inactivate these drugs was investigated.

(2) There was no inactivation of either oxytocin or vasopressin by the plasma of non-pregnant women.

(3) Plasma from women in mid-pregnancy partially inactivated oxytocin. The amount of oxytocin inactivated by the plasma decreased with the duration of pregnancy. Plasma taken towards term usually failed to inactivate oxytocin.

(4) The persistence of some oxytocin-inactivating power in the plasma of women at term was associated with the subsequent occurrence of prolonged labour. This was especially noticeable in the case of uterine inertia.

(5) Plasma taken during pregnancy, at term or during labour partially inactivated vasopressin. The amount inactivated increased with the duration of pregnancy. No vasopressin inactivation occurred with plasma taken at 7 days post-partum.

The authors wish to thank Professor W. C. W. Nixon for allowing one of us (S.E.D.) to take blood samples from women attending the Obstetric Unit, University College Hospital. It is a pleasure to acknowledge Miss J. Nunn's technical help.

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FIVE CASES OF BASAL-CELL CARCINOMA OF THE VULVA

BY

JOSEPH WARD, M.R.C.O.G.

Senior Registrar in Obstetrics and Gynaecology

King's College Hospital, London

INTRODUCTION

THE purpose of this paper is to record 5 cases of basal-cell carcinoma of the vulva and to review the literature on this subject.

Most textbooks omit to mention that basal-cell carcinomata occur in this region. This places it in a position of inappropriate obscurity in the differential diagnosis of vulval neoplasms.

I have been able to trace mention and description of 77 cases in the literature but unfortunately clinical and pathological details are missing in the great majority of these reports, thus making impossible a complete analysis. However, by using the information available, some interesting facts are found to emerge.

Case 1

Mrs. E.B., age 90 years, was seen on the 15th May, 1949, complaining of a tumour of her vulva.

Her menstrual history was normal and her menopause had occurred 40 years previously. She had 6 children.

In 1948 she had a right-sided hemiplegia but she had recovered almost completely. Considering her age, her physical condition was good.

The tumour of which she was complaining had been present for about a year. It was the size of a pea 9 months previously but for 3 months it had increased considerably and now it rubbed when she walked. There had been a thin serous discharge for several months and during this time pruritus had been troublesome. There had been no bleeding.

On examination she had degenerative arterial changes but few residual signs of her hemiplegia. Arising medial to the right genito-crural fold from the outer and lower third of the right labium majus was a stunted mushroom-like papilloma. The short stout pedicle or stalk was about 1 cm. long and 3 cm. in diameter. This supported the overhanging proliferating head which was 6 cm. in diameter and 1·5 cm. thick.

The pedicle was covered by normal skin but this appeared to change in character as the pedicle joined the tumour cup for it lost its brown pigmented colour and became white and thickened. The upper surface of the cup was ulcerated in one area about 1 cm. in diameter and the edges of the ulcer were irregular, rolled and overhanging. The base of the ulcer was firm and yellow and from it exuded a serous discharge. It did not bleed on probing as it was fibrotic. The remainder of the surface of the tumour had a white thickened epithelial covering which was divided up by deep irregular sulci, resembling in miniature those of the cerebral cortex. The tumour was quite painless. The firm fibrous pedicle was attached to the underlying subcutaneous vulval fat but not to deeper structures. There was no lymphadenopathy.

The tumour was excised under local analgesia together with 1·5 cm. of normal surrounding vulval skin around its base. The patient made an uninterrupted recovery and the wound healed by primary intention.

Macroscopically the divided fibrous tumour, which cut like a scirrhus carcinoma, was connected to the subcutaneous fat by a fibro-fatty stroma in the stalk which itself was covered by normal skin.

Microscopically it appeared to be a basal-cell growth of the reticular type with the larger masses of epithelial cells enclosing areas in which vacuolation was occurring giving the impression that the tumour may have been from sweat glands or an abortive attempt by the growth to form new glandular structures. In places the surrounding stroma was abundant and hyaline. The surface epithelium was in the main intact over the superficial epidermal basal-cell carcinoma (Fig. 1).

Case 2

Mrs. F.C., age 60 years, was seen on the 12th March, 1952, complaining that for 5 years she had suffered from increasing thickening of the skin of her hands and feet, multiple small areas of thickening of the skin of the trunk, ulcerated warts on her right hand and a small vulval tumour. She had 2 children and her menstrual history had been normal up to her menopause in 1940. Between 1936 and 1946 she had taken medicine containing arsenic to alleviate her menopausal symptoms.

In 1948 she had been treated surgically for bilateral glaucoma but otherwise she had not suffered from any illnesses until 1950 when she first sought treatment for her present skin lesions. In that year she had received beneficial local treatment with ointments for the hyperkeratosis and associated fissuring of her hands: she also had an ulcer excised from the base of the first right interdigital cleft and this had healed satisfactorily.

However, in 1951 she developed horny warts on the dorsum of the right index finger and on the ulnar surface

of the right hand. The ulcer at the base of the 1st interdigital cleft recurred. Many small hypertrophic areas of keratinization of the epidermis of the trunk increased in number and size. The growth on the left side of the vulva became a small slightly ulcerated tumour which bled easily.

Her general physical examination in 1952 revealed cardiac hypertrophy, chronic bronchitis and the following skin lesions:

On the left labium majus was a pedunculated tumour 3 cm. in diameter with a small stalk 1 cm. in diameter. It had an irregular corrugated surface from which there was a serous discharge. It was firm, mobile, and free from infiltration and induration at its base but it bled quite easily. There was no lymphadenopathy.

On the ulnar border of the right hand there was a hard dry sessile papilloma of dark brown-black keratinized skin 2 cm. long and 0·5 cm. in diameter arising from a broad base.

On the dorsum of the right index finger was a similar slightly smaller dome-shaped papilloma 0·5 cm. in diameter. On the right thenar eminence there was an ulcer 1·5 cm. in diameter with an irregular everted edge and indurated nodular base. On the trunk were several small hyperkeratotic brown elevations of the skin.

Lesions 1, 2, 3 and 4 were excised together with a good margin of normal skin. The large raw surface on the thenar eminence was covered by a Thiersch graft. Healing was rapid and good in each area.

The pathological report stated that the pedunculated tumour 1 on histological examination was a rodent ulcer. Sections of 2 and 3 were squamous cell papillomata which were producing much keratin. Section of ulcer 4 showed a well differentiated squamous cell carcinoma (Broder's Grade II).

When last seen in the follow-up clinic on 14th June, 1954, she was free from recurrence and further lesions (Fig. 2).

Case 3

Miss L.B., aged 55 years, presented herself on 22nd September, 1953. Her menopause in 1939 followed a normal menstrual history. Following poliomyelitis, when 5 years of age, she had been crippled in both legs and, in spite of numerous operations, she was still unable to walk.

In 1948 she noticed for the first time a slight soreness of a small patch of skin on the right side of the vulva and this she treated with local applications of zinc oxide ointment. Every few months since 1948 there had been a recrudescence of her symptoms of slight pain and inflammation of the small patch of skin and for about one year there had also been a slight serous exudate and very occasionally slight bleeding. Irritation was often present on these occasions. In September, 1952 and January, 1953 there had been considerable secondary infection with induration and tenderness around this slightly raised patch of skin at the junction of the upper and middle third of the labium majus

Except for her paralysed legs which had assumed a position of close adduction, her general physical condition was good. Almost level with the clitoris and one inch lateral to it on the anterior surface of the right labium majus at the junction of the middle and upper third was a pyramidal area about 1 cm. in diameter. It was coppery red, sessile, granular and scaly. This circular plaque was elevated about 0·2 cm. above the surrounding skin and had a slightly irregular margin. There was a lack of induration, inflammation, fixity to deep tissues, palpably enlarged lymphatic nodes and tenderness. A diagnosis of a cystic rodent ulcer was made and the patient admitted for treatment.

On 23rd September, 1953, under general anaesthesia, the tumour, the underlying subcutaneous fat and a good margin of the surrounding normal-looking skin were excised.

On 3rd October the patient was discharged, the incision having healed by primary intention. On the 1st February, 1955, she was free from recurrence.

Pathological Report

The specimen consisted of a diamond-shaped piece of skin 1·8 cm. in length. On the surface was a slightly raised brownish area 1 cm. in length. It had irregular margins and a roughened surface. Slicing through it showed a minute cystic space in one area.

Section showed a rodent ulcer with a quite heavy chronic inflammatory infiltrate in the underlying tissue. A wide ring of normal skin surrounded the tumour (Figs. 3 and 4).

Case 4

F.C., age 62 years, was seen for the first time on 15th June, 1954. She was complaining of a lump in her right groin which she said had been a pimple 18 months previously, having slowly increased in size and become ulcerated and slightly exudative during that time. Because of the crusting she had bathed it repeatedly with boracic acid lotion. There had been no pruritus nor bleeding and only slight tingling. She had no past history of serious illness but in 1929, following menorrhagia and cervicitis, a total hysterectomy had been performed "following two radium treatments because of the possibility of carcinoma", she stated. There had been a normal delivery of one child in 1924.

Her general condition was fairly good but she had a severe hypertension, a cardiac arrhythmia with extrasystoles and a mild retinal arteriosclerosis.

On the upper and outer aspect of the right labium majus she had a small ulcer 2·5 cm. long and 1 cm. wide. It had a beaded, raised, rolled, red, dry edge with a granular yellowish white base free from any induration, inflammation and fixity. The lymph glands in the groins were not enlarged.

A confident diagnosis of a rodent ulcer was made and on 15th June, under general anaesthesia, the ulcer was excised taking at least 1·5 cm. of normal skin around its edge. She was discharged on 23rd June with the wound fully healed. Repeated observations to 1st March, 1955 show there is no recurrence.

Microscopically the ulcer is surrounded by normal skin. It is a typical basal-cell carcinoma (Figs. 5 and 6).

Case 5

Mrs. M.J., age 82 years, was seen in the Gynaecological Clinic on the 14th February, 1955, complaining of a tumour on the left labium majus. She had noticed a small painless wart about 2 years previously and this had slowly increased in size. For 6 months there had been smarting when urine passed over the growth and some pain when it was pressed upon as when sitting. There had been no discharge nor bleeding from the tumour nor from the genital tract. The periods ceased at 45 years of age. She had been delivered normally of a child.

She had always enjoyed good health.

On examination her general physical state was good for her age. On the lower and outer third of the left labium majus protruding 2 cm. from the skin surface was a pedunculated tumour 4 cm. long and 2 cm. broad. It was firm in consistency and had a convoluted surface. The skin appeared to be intact over its surface for there was no ulceration. It was not attached to deep structures, it was freely mobile and there was no lymphatic gland enlargement.

On 23rd February, 1955, under general anaesthesia, the tumour was excised together with 1 cm. of surrounding skin. The subcutaneous tissues were not infiltrated and deep excision was not performed.

The patient was discharged on 6th March with the wound well healed.

Pathological Report

The specimen consists of a rounded white mass 4 cm. long and 2 cm. in diameter which is lobulated and attached to a small piece of skin.

Sections show a rodent ulcer with areas of cystic change (Figs. 7, 8 and 9).

Clinical Classification of Basal-Cell Carcinoma

There are four main types:

(1) *Ulcerative or Rodent Ulcer Proper*

(a) *Superficial Type*. This has a quite sharply defined overhanging margin which is beaded and forms a burnished chronic indolent ulcer growing laterally rather than in depth. Case 4 is a typical example.

(b) *Deep Terebrant Type*. This has a well defined margin but a deep ulcer crater. New growth and ulceration progress rapidly and more particularly in depth than on the skin. It may be a later stage of (*a*) or be highly erosive from the start.

(2) *Superficial Cicatrizing or Erythematous Type*

Sequeira (1927) describes this as a flat infiltration of the skin with a smooth waxen surface where ulceration occurs late or a sclerotic scar without ulceration surrounded by a rim of small greyish elevations. Case 3 is a typical example of this very rare type (Savatard, 1924).

(3) *Hypertrophic Type*

Ulceration is unusual or late. The neoplasia causes subcutaneous tumour formation and finally a polypoidal excrescence forms which may then develop traumatic ulceration of the overlying thickened intact epidermis. Brooke's (1892) epithelioma adenoides cysticum may be of such a type. Cases 1 and 5 are examples of this rare condition (Savatard, 1924).

(4) *Compound Type*

All the above types may be single or multiple lesions. Some of the characteristics of all these types may be found together in the same patient and in the same lesion, i.e., the late stage of the cicatrizing type when ulceration has occurred forming a Jacob's Ulcer.

Pathology

In 1827 Jacob, an Irish ophthalmologist, gave the first description of rodent ulcers. Krompecher (1902) suggested the histopathology of the tumour from the basal layer of the epidermis. Mallory (1910), Kryle (1916), Haythorn (1931) and Foote (1947) have made attempts to find an alternative histogenesis. However, in spite of their suggestions and also that of Lever (1948), who considered basal-cell tumours were not carcinomata and not derived from basal-cells but that they were nevoid hamartomas derived from embryonal primary epithelial germ cells, Krompecher's views appear to remain the generally accepted. It is agreed, however, that the adnexal theory of origin is rational because of the close morphogenetic relationship of the hair follicles, sebaceous glands and the epidermis.

MacCormac (1910), after studying a series of cases between 1902 and 1908, attempted to classify rodent ulcers within the group but again in spite of this and repeated attempts by more recent workers there is no final agreement on this division. Following MacCormac's histopathological division into (1) pure rodent ulcers, (2) mixed rodent ulcers and (3) intermediate

types, Darier and Ferrand (1922) stated that 50 per cent of skin epitheliomata are prickle cell carcinomata, 30–40 per cent are basal-cell epitheliomata and 10–15 per cent are meta-typical epitheliomata (carcino-spino-baso-cellulare). Emphasizing his belief in the adnexal theory of origin of rodent ulcers, Foote (1947) divided the group into pilar, sudorific and primordial types. Lennox and Wells (1951) found this an impossible method of classification and they described the four common histological forms of differentiation to be seen in rodent ulcers and attempted to classify them accordingly. Using this method based on the presence of pigmentation, palisading, fluid formation and whorls, they concluded that the evidence was against any histologically separable types, there was no association between the differentiations, that the unitary nature of the rodent ulcer group was supported and that they did not believe there could exist a group of tumours transitional between rodent ulcer and squamous carcinoma.

The complexity of the histopathological picture in rodent ulcers as a group will be easy to acknowledge if we accept (1) Krompecher's (1902) and Molesworth's (1927) observations that it is impossible to make a sharp separation between basal-cell growths of the superficial and deep types; (2) that basal-cell carcinoma may arise from the epidermis, or from embryonic remnants of basal-cells; (3) the belief of Willis (1948) that pilo sebaceous and sweat gland tumours appear and behave so similarly to basal-cell tumours as to be indistinguishable—although Muir (1951) disagrees with this view, and (4) the evidence of Lennox and Wells (1951) that a rodent ulcer may show a superficial or deep array of basal-cells exhibiting any combination or arrangement of palisading, pigmentation, multiplicity of sites of origin, whorls, fluid formation, duct formation, sebaceous differentiation, squamous differentiation, hyaline stroma or keratin formation.

Statistics

The Incidence of Basal-Cell Carcinoma

As stated a complete and detailed analysis of all the basal-cell carcinomata of the vulva mentioned in the literature is not possible for many cases are not fully described. Thus MacCormac (1910), Prytek (1914), Mosto and Radice (1939), Göbel and Hamann (1937), Folsome (1941), Smith and Pollack (1947), Palmer, Sadugor and Reinhard (1949), Watson and Gusberg (1946), Thackray (1951), Watson and Counseller (1951), Newell and McKay (1952), Way (1951), Gauducheau and Tardiveau (1949), Dantoine (1949) and Desaive *et al.* (1950) omit detail whilst some would appear to be doubtful cases and I am not including therefore those of Jess (1932), Rutter (1917) and Fabre (1932), nor those scrotal rodents of Thackray (1951) and Pierard and Dupont (1948). The remainder of the cases yield some useful information.

The Incidence of Vulval Basal-cell Carcinomata Compared with the Incidence of Rodent Ulcers Elsewhere in the Body

Wakeley and Childs (1949) found that in 237 cases of rodent ulcer only 27 were outside the face and scalp area. They had 4 cases at the anal margin, 2 to the left, 1 to the right and 1 posterior to it.

Cade (1940), quoting the figures of the National Radium Commission for 1937–38, gives the incidence as head and neck 98·4 per cent and trunk and limbs 1·6 per cent.

Lennox and Wells (1951), analyzing 150 cases, found the incidence on the non-exposed sites to be 15·3 per cent.

MacCormac (1940) found 42 out of 43 rodents were on the head and neck and 1 on the vulva.

Thackray (1951) says that out of 210 cases all but 20 were on the head and face. He found 1 in the groin, 1 on the vulva and 1 on the scrotum.

The vulva is a rare site for rodent ulcers which are not uncommon lesions elsewhere in the skin.

Incidence of Vulval Rodent Ulcers in Relation to Squamous-Cell Carcinoma of the Vulva

Way (1951) estimated that about 600 cases of vulval carcinoma should occur annually in England and Wales. He treated 314 cases and found only 2 rodent ulcers. This would agree with the statement of MacLeod and Read (1955) that rodent ulcer of the vulva is a rare disease. Taussig (1940) saw no rodent ulcers in his series of 155 carcinomata of the vulva, likewise

FIG. 1

Case 1

(*a*) Showing typical basal-cell structure. ×50. (*b*) Showing palisading and cystic cell formation. ×50. (*c*) The tumour before excision. (*d*) High magnification showing pseudo-acinar and fluid formation. ×250. (*e*) The tumour with its pedicle uppermost. (*f*) The tumour bisected.

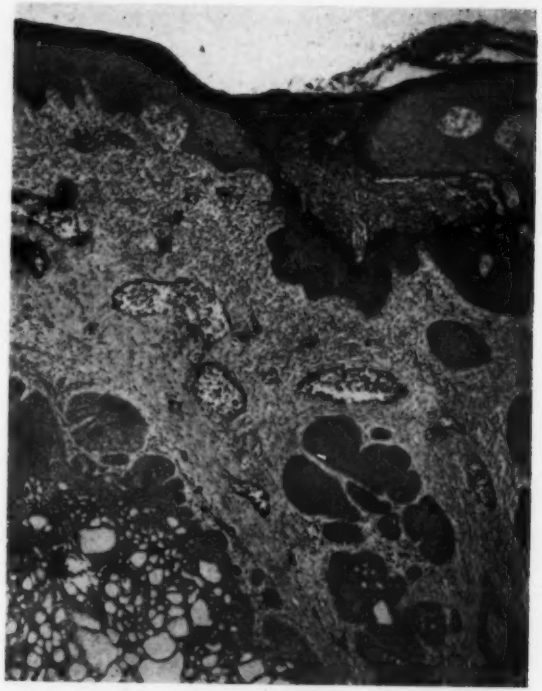

FIG. 2.
Case 2. ×50.

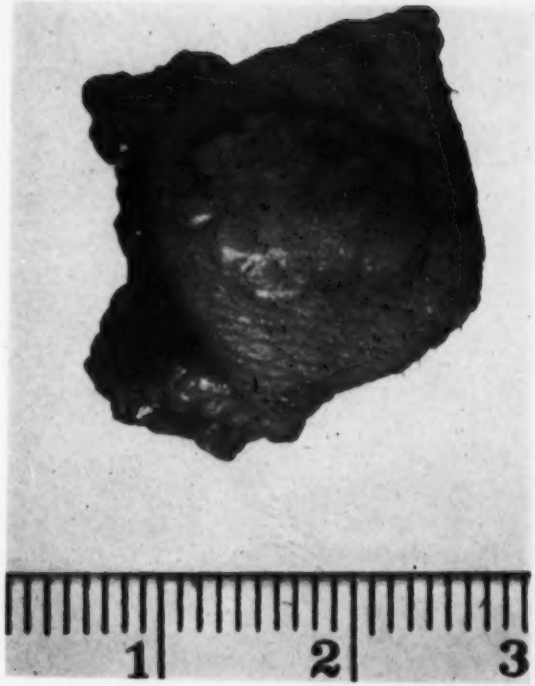

FIG. 3
Case 3. Excised lesion (scale in centimetres).

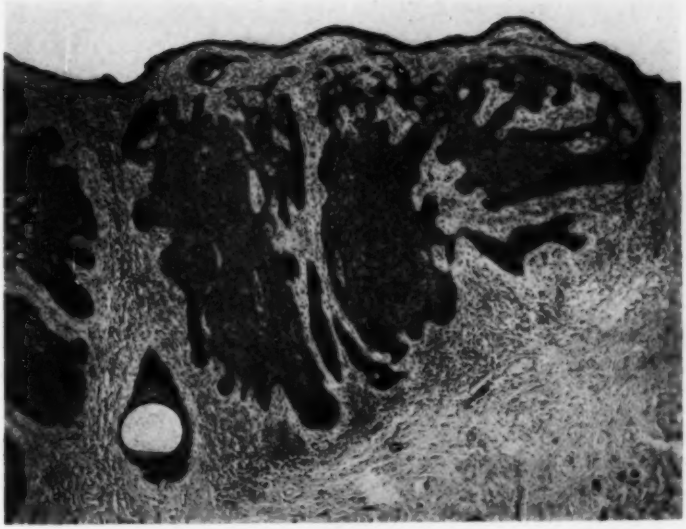

FIG. 4
Case 3. ×5C.

FIG. 5
Case 4. Lesion *in situ*.

J.W.

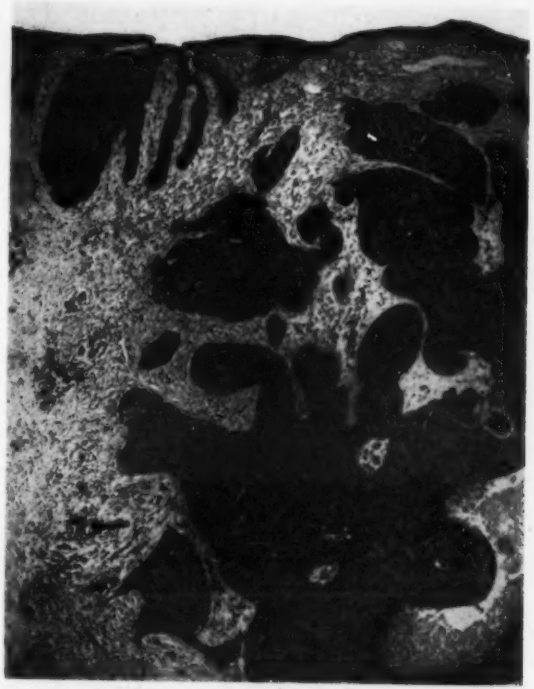

FIG. 6
Case 4. ×50.

FIG. 7
Case 5. Excised tumour, lateral view (scale in centimetres).

FIG. 8

Case 5. Excised tumour, posterior view (scale in centimetres).

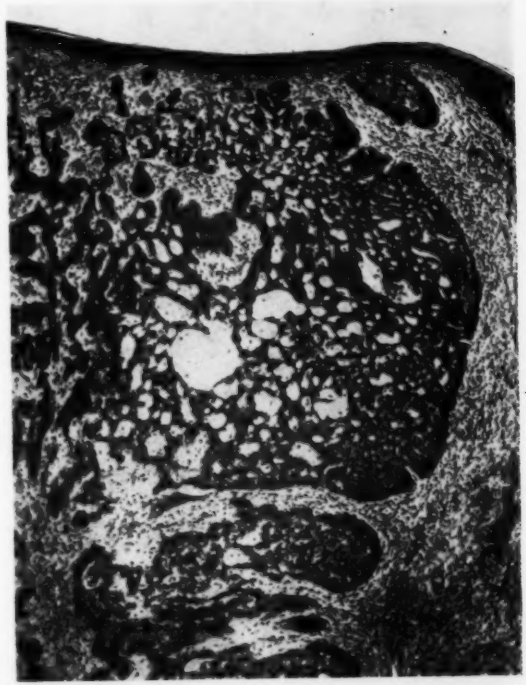

FIG. 9

Case 5. ×50.

Blair-Bell and Datnow (1936) in 22 cases and Rentschler (1939) similarly in none of his 71 cases of vulval carcinoma.

MacCormac (1910) in his series reports 1 case of squamous-cell carcinoma of the vulva, 20 cases of other skin carcinomata, 1 case of basal-cell carcinoma of the vulva and 42 rodent ulcers elsewhere on the body.

Wright (1951) states that at St. George's Hospital between 1936 and 1949 there were 11 cases of vulval carcinoma of which none were basal-cell in type but there were 70 rodent ulcers in other body sites.

The incidence of vulval basal-cell carcinoma relative to vulval squamous-cell carcinoma has been found to be approximately 8 per cent in the series noted below. If the incidence of vulval malignancy is 4 per cent of female genital tract malignancy as shown by Schreiner and Wehr (1934), Smith and Pollack (1947) and Desaive *et al.* (1950), the incidence of rodent ulcer of the vulva is approximately 0·4 per cent of female genital tract malignancy (Table I).

Age

Basal-cell carcinomata of the body in general occur at any time from youth to old age. Sequeira (1927) records 3 cases in children but the great majority are in the older age group of sixty and thereabouts, as shown by Wakeley and Childs (1949), Lennox and Wells (1951), who found a mean of 65·1 years, standard deviation of 10·1 years, and Thackray (1951), who found 65 cases aged 60 to 69 years and 66 cases aged 70 to 79 years out of a total of 243 cases, giving his 70 to 74 age group the highest incidence. An analysis of 21 cases of basal-cell carcinoma of the vulva is found to follow the general incidence, for the average age was 62 years, all 21 occurred between 40 and 90 years and 56 per cent were in the two decades of 50 to 70.

Sites

The covered parts of the body surface are not a common site for rodent ulcers. On the vulva, the labia majora are by far the commonest sites. Smith and Daly (1950) described a case with a rodent ulcer on the labium minus and this they claim was the first reported case of primary involvement of this area.

Berman (1941) reported a case with the ulcer involving the left labium majus and the prepuce. His 4 cases were all on the left side of the vulva but there is in general no predilection for left or right.

Gauducheau and Tardiveau (1949) reported one case involving the anterior vaginal wall and urethra.

Labial rodent ulcers may be single or multiple just as rodent ulcers in other parts of the body. Temesvary (1926) reported a case which had multiple small nodules over the labia majora. Folsome (1941) reported 6 cases in 3 of which there was a rodent ulcer elsewhere in the body and in 2 cases the vulva showed multiple rodent ulcers. Lennox and Wells found 7·3 per cent with multiple rodent ulcers in their general series, 1 case having 12 and 2 cases having innumerable tumours. One case of Berman's showed involvement of the left labium majus and the mons veneris.

Two cases have been recorded with rodent ulcers at the site of a local vulvectomy scar, the vulva having been excised for pruritus.

Aetiology

There was one case with an associated leucoplakia of the vulva but this appears to be such an unusual association as to be quite coincidental. Syphilis was present in one case and had been present in another. These had been treated with arsenicals so that possibly the aetiological factor in the origin of the rodent ulcers in these cases was the arsenic rather than the syphilis. The Wassermann was negative in Wilson's (1941) case but in that of Goldberg (1937) it was persistently positive in spite of much therapy and biopsy showed not only a basal-cell carcinoma, and a healing gumma, but also Bowen's Disease of the vulva. The case reported in the present series indicates fairly conclusively an association between arsenic, rodent ulcer, hyperkeratosis and squamous-cell carcinoma, for these three lesions were found following prolonged arsenical medication. The hyperkeratosis of reaction to wind and sun, and senile hyperkeratosis are aetiological factors in the development of rodent ulcers.

TABLE I

Incidence of Basal-cell Carcinoma of the Vulva in Relation to Other Types of Carcinomata of the Vulva

Author	Number of Basal-cell Carcinoma of Vulva	Number of Carcinoma of Vulva	Percentage of Basal-cell Carcinoma of Vulva	Types of Vulval Cancer	
Way (1951)	2	314	0·64		
Newell and McKay (Boston) (1952)	1	60	1·7	Basal-squamous carcinoma	1
Siegler and Green (Kings County) (1940–50)	4	49	8		
Desaive *et al.* (Liege) (1930–50)	5	102	4·9		
Watson and Counseller (1945–49)	1	103	0·9	Epidermoid (8 *in situ* lesions)	73
				Melanomata	4
				Adenocarcinomata	6
				Leiomyosarcoma	1
				Basal-cell (18 with no histology)	1
Palmer *et al.* (1913–47) / Schreiner and Wehr (1913–33)	4	313	1·3	Epidermoid	300
				Melanomata	7
				Adenocarcinoma Bartholin gland	1
				Myosarcoma	1
				Basal-cell	4
Watson and Gusberg (1946)	3	30	10	Squamous-cell carcinoma	24
				Melanomata	2
				Adenocarcinoma from a sweat gland	1
				Basal-cell	3
Taussig (1940)	—	155			
Wilson (Duke Hospital, Durham N.C.) (1941)	4	32	12·5		
Berman (St. Louis) (1927–41)	4				
Smith and Pollack (Memorial Hospital, New York) (1926–43)	9	225	4	Epidermoid	189
				Melanomata	25
				Basal-cell	9
				Adenocarcinoma Bartholin gland	2
				Vulvar Paget's Disease	1
				Dermatofibrosarcoma protuberans	1
Göbel and Hamann (1915–37)	9	61	15	Squamous-cell	44
				Basal-cell	9
				Early carcinoma	3
				Type not specified	5
den Hoed (1936)	1	41	2·4	36 confirmed microscopically	
MacCormac (1910)	1	1			
Mosto and Radice (1939)	1	23	4·3		

The hydrocarbons (see Bell, 1876) and ultra-violet light (Molesworth, 1927) cannot be incriminated in the causation of vulval basal-cell lesions but deep X-ray therapy may possibly be involved for in one case where it had been administered for pruritus vulvae a basal-cell carcinoma subsequently developed.

Endogenous agents such as hormones may have some influence locally on the vulva in the production of these lesions—or perhaps the absence of ovarian hormones, for most of these patients were post-menopausal.

Chronic discharge as a cause could not be ignored for Wilson (1941) and Thurston (1951) each record a case which had received radical treatment in the form of total hysterectomy for persistent cervicitis.

Pruritus from whatever cause gives the chronic irritation which is probably the most constant aetiological factor and it is the most

constant single symptom in all the cases of vulval rodent ulcer found in the literature. Wilson (1941), Berman (1941) and Thurston (1951) each report a case where in spite of partial vulvectomy for pruritus vulvae, a basal-cell carcinoma later developed on the vulva of these patients.

Diagnosis

Claiborn and Holsinger (1932) quote a history of 34 years of pruritus vulvae in one of their cases of basal-cell carcinoma of the vulva, whilst Berman (1941) claims a 20-year and Siegler and Greene (1951) an 8-year history in one of theirs. Chronic pruritus vulva is the commonest symptom. Pain is not found so frequently and when present it is of short duration. Thurston's case had suffered a pricking sensation in the vulva for 10 months and similarly one of the cases reported in this present series. Pain caused by pressure when sitting, and stinging caused when voiding urine were noted also in 2 cases in this series.

Bleeding is an unusual symptom but a case of Siegler and Greene (1951) gave a 2-year history.

Serous discharge with resultant crusting is not uncommon in ulcerated tumours.

An ulcer or tumour is commonly the only complaint and, even when accompanied by other symptoms, it is this which most often precipitates the demand for treatment. Thus Claiborn and Holsinger (1932) report a case which had suffered 34 years from pruritus but only suffered the growth for 6 years. Berman (1941) describes a case suffering from pruritus for 20 years and a growth for 3 years. The great duration of symptoms and signs is important in the differential diagnosis of these tumours for in carcinoma of the vulva as reported by Newell and McKay (1952) the delay from the onset of symptoms to seeking treatment was on the average 13·8 months whereas Siegler and Greene (1951) found in basal-cell carcinoma of the vulva it was 6·6 years and in 2 of Berman's cases it was 4 years. In the present series it was 2·8 years.

The physical signs of the main types of basal-cell carcinomata have already been described and illustrated with photographs in the case records. That it is important to differentiate these tumours from such tumours of the vulva as xanthomata, fibromata, and myoblastomata was emphasized by Wright (1951): likewise from Bowen's Disease, Paget's Disease, squamous-cell carcinoma, pigmented moles, melanomata, syphilitic ulcers, tuberculous ulcers, senile keratosis, psoriasis and hydradenomata. Parsons and Meigs (1946), quoting Speisser (1942), considered the histopathology of biopsy specimens to be most essential. Carter, Kaufmann and Cuyler (1950) found cytological investigation with smears to be a useful aid in the differentiation quickly between cancer and vulvar lesions of venereal aetiology.

Prognosis

Basal-cell carcinomata in general are remarkably amenable to treatment but sometimes in spite of treatment the tumour advances. A similar course may be expected with basal-cell vulval carcinomata but the results of treatment of lesions in this region in the past have certainly not been good as reported by Wilson (1941), who found that in 17 cases reported in the literature 36 per cent were dead from carcinoma within 5 years of the diagnosis, and partly because of the age group the 5-year salvage was only 24 per cent. Siegler and Greene (1951) draw attention to the post-operative mortality by describing 4 cases in which there were 2 post-operative deaths whilst a third case died within 2 years from recurrences after treatment. Smith and Pollack (1947), recording 5 cases, found 4 alive at 2 years, 3 alive at 5 years and 1 had died of a cause unrelated to cancer. Thus too much treatment may give as bad a prognosis in this age group as inadequate therapy, and this realization prompted Berman (1941) to make a plea for biopsy and wide excision to avoid extensive procedures causing a high operative mortality. The assessment of the probability or otherwise of metastases or local recurrences will enable a prognosis to be given.

Do metastases occur? Savatard (1924) and Willis (1948) described cases of rodent ulcers of intermediate type of cell which yielded metastases and emphasized that several parts of the growth must be examined microscopically to make sure the tumour is not of mingled or intermediate type. Cade (1940) mentions that involvement of the lymph glands does occur in

mixed or borderline types of lesion; he had treated 1 out of 183 cases in 13 years. Beadles (1894) reported lymph node involvement and De Navasquez (1941) reported blood spread.

It was considered that basal and transitional squamous-cell tumours did not metastasize but mixed basal-squamous cell tumours did so. Thus Wilson and others excluded the latter from their lists of basal-cell carcinomata but included the transitional ty with the results as stated.

Lennox and Wells (1951) considered it unlikely that there existed any group of tumours transitional between rodent ulcer and squamous carcinoma. If this be so the prognosis will depend on adequate local excision of the tumour after accurate histological diagnosis.

Thackray (1951), after analyzing 850 cases of rodent ulcer from all sites of which 200 were followed up for 10 years, considered the prognosis to be simple, it being only necessary to be sure that the margin of the excised tissue was free from growth for, of the other histological features studied, only the extent to which the growth was infiltrative seemed to have any direct bearing on the prognosis.

Treatment

Prophylactic treatment in the form of eradication or avoidance of any endogenous or exogenous aetiological factors is essential.

Local treatment may take the form of local excision or treatment with X-rays, radium (Smithers, 1949), carbon dioxide snow (Brain, 1949) or even curettage and applications of acid nitrate of mercury to small ulcers. Good results in large series of cases of facial rodent ulcers have been recorded using either radiation or excision and this choice is available for vulval tumours.

Gauducheau and Tardiveau (1949) treated a basal-cell carcinoma under the anterior urethra very successfully with radium. Generally on the vulva wide local excision can be accomplished without fear of injury to near important structures. Excision is usually easy and primary healing is rapid and good with or without the added aid of grafting (Cheatle, 1903). It has the further advantage of allowing confirmation of the biopsy specimen histologically and also of making closer examination of the excised normal surrounding skin in order to be sure that the whole tumour has been extirpated.

Summary

Five cases of basal-cell carcinoma of the vulva have been described in detail.

A review of the literature on this tumour in this site has been made. The age incidence, the aetiological factors, the diagnosis, the relative frequence compared with other vulval tumours, the pathogenesis, the prognosis and the treatment have been examined and compared with those of like tumours in other sites.

The plea for biopsy and careful histological diagnosis coupled with radical but local excision and 5-year follow-up has been made.

I am indebted to Mr. S. G. Clayton for helpful criticism of this paper and for his permission to publish details of Cases 3 and 5. I am grateful to Mr. J. H. Peel and Dr. D. I. Williams for permission to publish details of Cases 4 and 2 respectively. My thanks are also due to Professor H. A. Magnus and his staff for some of the photomicrographs and the pathological reports on these cases. I am deeply grateful to Dr. E. D. Y. Grasby for permission to publish Case 1 and also to Mr. A. W. Kendall for permission to record details of treatment of Case 2.

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SPONTANEOUS CEPHALIC VERSION IN THE LATER WEEKS OF PREGNANCY AND ITS SIGNIFICANCE IN THE MANAGEMENT OF BREECH PRESENTATION

BY

A. JAMES WHITE, M.B., D.Obst.R.C.O.G.

Registrar in Obstetrics and Gynaecology

Marston Green Maternity Hospital and Hospital for Women, Birmingham

IN this country breech presentations are usually treated by external version. This article attempts to show that better results are obtained without routine external version.

This opinion is based on studies of the rate of spontaneous version, of the foetal mortality and probable success rate of external version, and on the results of breech delivery.

Firstly an attempt was made to determine the rate of spontaneous cephalic version after the 34th week. It is usually agreed that spontaneous version is common before that time, but it is often stated to be infrequent afterwards. To obtain unequivocal evidence on this point it was decided to depend only on observations that were confirmed radiologically.

Routine external version was abandoned in January, 1954. Observations on spontaneous version were commenced in April, 1954, and between that date and May, 1955, 3,000 patients passed through the clinic and were subsequently delivered in the hospital. Of these 375 were excluded, being patients booked after the 34th week, emergencies, twins, abnormal babies, or cases of premature labour before the 34th week, leaving 2,625 who were examined at the end of the 34th week and who had a single pregnancy with a normal foetus. Among these there were 189 (7·2 per cent) who had a breech presentation confirmed radiologically at the end of the 34th week. There were 9 other cases in which breech presentation was diagnosed clinically and spontaneous version apparently occurred but as these were not X-rayed they were excluded. Twelve other cases in which spontaneous version was confirmed radiologically were excluded because it was thought subsequently that the dates had been incorrect.

Of the 189 patients having radiologically confirmed breech presentations at the 34th week, 19 had external versions performed or attempted, leaving 170 patients on whom no attempts whatever at external version were made.

The subsequent history of these 170 cases was that spontaneous cephalic version and eventual delivery by the vertex occurred in 87 (51 per cent); 83 (49 per cent) remained as breeches. Of the 170 cases 83 were primigravid breeches, of which 26 (31·3 per cent) underwent spontaneous version and were subsequently delivered by the vertex; there were 87 multigravid breeches, and of these 61 (70·1 per cent) underwent spontaneous version and were subsequently delivered as vertices.

These version rates occurring spontaneously are not so very much lower than those obtainable by routine external version. It is not surprising, therefore, to find that the incidence of breech delivery among normal, single foetuses over 4½ pounds in this series was 3·2 per cent, which does not differ greatly from the incidence in hospitals where routine external version is practised.

Among the primigravidae in whom spontaneous cephalic version occurred, the incidence of frank breeches (i.e., both legs extended) was 71 per cent. The incidence of frank breeches among the primigravid breech deliveries was 75 per cent. The corresponding figures for the multigravidae were 62 per cent frank breeches in the group undergoing spontaneous version, and 67 per cent among the breech deliveries.

This means, of course, that the incidence of spontaneous version was almost as high among the frank breeches as among the flexed breeches, which was a surprising finding. In the later weeks of pregnancy, then, the attitude of the legs would not appear to be an important factor in determining whether spontaneous version will occur. In earlier pregnancy it is presumably otherwise, explaining the predominance of extended breeches at 34 weeks and at term.

The various weeks at which spontaneous cephalic version occurred are shown in Table I.

Once spontaneous version after the 34th week had occurred, reversion to breech appeared to be very unusual. Some foetuses, however, performed more than one version before being delivered as vertices. This was only of incidental interest and no special effort was made to obtain radiological evidence of spontaneous podalic version, but there were 6 cases in which X-rays showed that the foetus had gone from vertex to breech and back to vertex.

Foetal Mortality

There was no foetal mortality among the cases undergoing spontaneous version, either from the version itself or from the subsequent delivery.

Cases Having External Versions in This Series

Nineteen patients had external version performed or attempted. Eleven of these were for contracted pelvis. The other 8 were in such cases as changed from breech to transverse lie, or where version was performed or attempted elsewhere than in our clinic.

Comparison with Previous Series

Several previous writers have given estimates of the frequency of spontaneous cephalic version but the conditions under which the observations were made usually differed in the following particulars from those of the present series:

(*a*) Observations were made over a wider period of pregnancy, usually commencing at about 24–28 weeks.

(*b*) The diagnosis of breech presentation was usually based on clinical grounds only.

(*c*) External version was being performed.

Newell (1941) noted only 19 per cent spontaneous cephalic versions but he was performing external version from the 28th week onwards, so presumably anticipated many which would have been spontaneous versions. This applies also to Grimes *et al.* (1952) who noted 35 per cent spontaneous cephalic versions; they were performing external version from the 6th month onwards. Vartan (1945) found spontaneous cephalic version occurring in 65 per cent of the multigravidae and in 60 per cent of the primigravidae, but his results take in cases from the 25th week onwards; he also was performing external version.

Vartan noted that only 4 per cent of the spon-

TABLE I
Stage of Pregnancy in Weeks at Which Spontaneous Cephalic Version Occurred

Primigravidae							
Stage of Pregnancy in weeks	34–35	35–36	36–37	37–38	38–39	39–40	40–41
No. of cases occurring during the week ..	11	7	4	3	1	0	0
Percentage of total no. of versions	42	27	15	12	4	0	0
Multigravidae							
Stage of Pregnancy in weeks	34–35	35–36	36–37	37–38	38–39	39–40	40–41
No. of cases occurring during the week ..	22	11	10	9	6	3	0
Percentage of total no. of versions	36	18	16	15	10	5	0

N.B.—The figures refer to the end of the stated week; e.g., 36–37 means from the end of the 36th week to the end of the 37th week.

taneous versions reverted to breech, compared with 22 per cent of his external versions. His low reversion rate after spontaneous cephalic version agrees with the findings in the present series. His high reversion rate after external version agrees with other writers, whose results are given later.

In 1952, Weisman made a valuable contribution when he presented to the American Congress of Obstetrics and Gynecology an exhibit of X-ray studies on 800 primigravidae. The results do not seem to have appeared in any journal, but are quoted by Greenhill (1952). Weisman found that at the 5th month, 42 per cent of foetuses were either breech or transverse. By the 7th month after some version only 12 per cent were breech or transverse. One or two weeks before term only 3·3 per cent were presenting as breeches. This incidence of 3·3 per cent persisted until term. Greenhill remarks, "since only 3 per cent in Weisman's study terminated as breech presentations, manual manipulation seems superfluous. Those which did not rotate spontaneously are perhaps better left unrotated, as the head may be suspended by umbilical cord entanglements. Weisman believes that attempts at external version may, in such cases, cause death."

The Results of Breech Delivery

For the purpose of the present enquiry it was necessary to know the foetal mortality from vaginal breech delivery in our hospital in booked patients with single pregnancies, the baby being normal, alive at the onset of labour, and of sufficient maturity that it should be capable of survival. Accordingly the gross breech mortality figures were corrected by excluding cases of prematurity, gross foetal abnormality, intrauterine death of the foetus before the onset of labour, multiple pregnancy, Caesarean section, cases seen for the first time as emergencies during labour, and deliveries which followed internal version.

It will be seen that cases complicated by such conditions as placenta praevia, pre-eclampsia, prolapsed cord, etc., have not been excluded, so that the series still contains many complicated, as well as uncomplicated, cases.

The border-line weight for prematurity has been taken as 4¼ pounds (1,928 g.) instead of the commonly used 5½ pounds (2,495 g.). The reasons for this are as follows:

(*a*) Four and a quarter pounds is the weight (to the nearest quarter of a pound) of the average foetus at the end of the 34th week of pregnancy (Crosse, 1952, and private communication). Babies weighing less than 4¼ pounds would therefore probably have been born as breeches even if external version were being employed, except in those clinics in which external version is used before the 34th week.

(*b*) Above 4¼ pounds a baby has a very good chance of survival if cared for in an efficient premature baby unit.

Having corrected the figures according to the above criteria it was found that between 1 January, 1949 and the last day of February, 1956 there had been 252 breech deliveries with 4 foetal deaths (stillbirths and neonatal deaths), a mortality of 1·6 per cent. There were 105 multiparae with 3 foetal deaths (2·86 per cent), and 147 primigravidae with 1 foetal death (0·68 per cent). The last 84 primigravidae in the series were delivered without foetal loss.

The foetal mortality in primigravidae is seen to be much lower than in multigravidae. This is due partly, perhaps largely, to the difficulty of ensuring always that there is an operator of experience present to supervise the deliveries in multigravidae if these should come off very suddenly. Cox (1950) found that the foetal mortality in breech delivery in the Liverpool teaching hospital was higher in multigravidae than in primigravidae and suggests that in hospital practice this probably applies to the country as a whole.

Caesarean Section Rate in this Series

In the corrected figures previously given Caesarean sections were excluded. If they are now put in, there were 25 Caesarean sections among 277 cases, an incidence of 9·0 per cent (7·1 per cent in multigravidae, and 10·4 per cent in primigravidae). In considering these figures it must be remembered that the series includes complicated as well as uncomplicated cases. No Caesarean section was performed in which the only indication was breech presentation; this would have been illogical in view of the

results obtained from vaginal delivery. The principal indications for Caesarean section were contracted pelvis (7 cases); repeat Caesarean section, usually associated with contracted pelvis (5 cases); prolapsed cord (4 cases); and placenta praevia (3 cases).

Selected Points in Our Management of Breech Presentation

All patients with breech presentations have a clinical estimation of the pelvis at the 34th week. If this is satisfactory no further action is taken until the 36th week, when, if spontaneous version has not occurred, a confirmatory X-ray pelvimetry is obtained. If at 34 weeks the pelvis is found to be contracted, external version is attempted; if this is unsuccessful and spontaneous version does not later occur, the patient has an elective Caesarean section at term.

No patient with a breech presentation is allowed to go past her expected date of delivery, because of the danger of postmaturity which breech babies appear to stand very badly; induction at term is practised, by rupture of the membranes if necessary.

An anaesthetist is present for every breech delivery. Many of the deliveries are performed by the house surgeons, but all are supervised by the consultant or registrar except those few which come off too rapidly for this to be possible.

Assisted breech delivery is the method normally used. Løvset's (1937) manœuvre is usual for the shoulders. For the aftercoming head the Mauriceau-Smellie-Veit manœuvre is usually employed; not because it is necessarily superior to forceps, but because it is easier to teach to house surgeons. If there is any difficulty, forceps are applied.

We believe very firmly that once the baby is born to its umbilicus and its placental circulation therefore virtually cut off, the delivery must be completed within a short space of time for the maximum safety of the baby. We consider that the advocacy of slow delivery has sometimes been carried to extremes. Our aim is a maximum of 2 minutes from the birth of the umbilicus to the birth of the mouth; very frequently the delivery is completed in less time than this. In this series there was never trouble after a delivery conducted in this way; babies which died did so after deliveries which had become prolonged. Intracranial haemorrhage can be due to trauma, to asphyxia, or to a combination of both. The head of a baby that is not asphyxiated can withstand moderate stresses, as witness a mid-forceps delivery in a vertex presentation. The head of a partly asphyxiated baby cannot stand any stress. The aim, therefore, should be to deliver the baby as expeditiously as is consistent with reasonable gentleness. In particular, not too much time should be spent in delivering the trunk in case the head should prove difficult and require extra time. The mother having pushed the baby out to its umbilicus, it is our practice, unless the shoulders follow almost immediately, to induce pentothal anaesthesia and complete the delivery. Here may be quoted the comments (on breech delivery) of DeLee and Greenhill (1947): "Movements must follow each other with deliberation, exactness, and speed . . . while a child may live five minutes after its placental circulation is cut off, it is greatly endangered and may die later of atelectasis, pneumonia, or of the cerebral results of profound asphyxia."

Published Series of Breech Deliveries

In Table II the results of breech delivery in some selected published reports are given. All show a foetal mortality (corrected) of less than 5 per cent; the average mortality is 2·4 per cent. Several modern series show mortalities under 2 per cent especially in primigravidae. The results in series delivered personally by their authors tend, of course, to be the best, and lend support to Greenhill (1952), who states that in the hands of specialists the foetal mortality from breech delivery is about the same as that from vertex delivery.

Foetal Mortality in External Version

The causes of foetal death in external version are well known and will be referred to only briefly. Placental separation may occur; the membranes may rupture, with subsequent premature labour; the cord may become entangled causing foetal death *in utero* or subsequently in labour; the cord may be caused to present, and subsequently prolapse in labour; direct trauma to the baby may occur; compound presentation

TABLE II
Selected Published Series of Breech Deliveries

Series	Number of Cases	Primigravidae or Multigravidae	Corrected Foetal Mortality Per cent
Goethals (1936). Boston Lying-in Hospital			
1930–34 for primigravidae	113	Primigravidae	3·5
1927–1934 for multigravidae	158	Multigravidae	3·9
Crosse (1939). Sorrento Maternity Hospital	100	Both	2·5
Hansen (1941). Private cases	126	73 primigravidae 53 multigravidae	0·8
Tompkins (1943). Philadelphia Lying-in Hospital			
Certified Obstetricians only	146	Both	2·7
Tompkins. Private patients from above series	139	Both	1·4
Moore and Steptoe (1943). Johns Hopkins Hospital			
Personal series	147	86 primigravidae 61 multigravidae	0·0 0·0
Rotunda Hospital (1935–45)			
Quoted by Munro Kerr and Chassar Moir (1949)	716	Both	3·6
Greig (1945). St. Helier Hospital, Surrey. Personal Series	60	Primigravidae	1·6
Guyer and Heaton (1946). Bellevue Hospital, New York	352	Both	4·5
Dieckmann (1946). Chicago Lying-in Hospital	524	Both	1·7
Ware, Winn and Schelin (1947).			
Medical College of Virginia Hospitals. Private patients	291	192 primigravidae 99 multigravidae	2·7
Trites (1948). Vancouver General Hospital			
Personal series	55	37 primigravidae 18 multigravidae	1·8
Løvset (1949). Women's Hospital, Bergen, 1940–47	Not stated	Both	3·9
Seeley (1949). Wayne University, 1942–46	467 (before correction)	Primigrivadae Multigravidae	1·5 1·4
Cox (1950). Liverpool Maternity Hospital, 1933–49	1,004	Both	4·98
Cox (1955). Liverpool Maternity Hospital, 1949–52	249	Both	2·4
Grimes *et al.* (1952). Emory University Hospital	144	Both	0·77
Daley and Michael (1953). St. Helier Hospital, Surrey	158 73	Primigravidae Multigravidae	1·9 4·1
White (1956). Marston Green Maternity Hospital, 1949–56	147 105	Primigravidae Multigravidae	0·68 2·86
Total	5,274	Both	2·4

may be caused (King and Mitchell, 1953; McCullagh, 1933). There are also dangers to the mother, such as accidental haemorrhage and ruptured uterus (Freeth and MacVine, 1951; McCullagh, 1933).

At Marston Green Maternity Hospital the foetal mortality from external version in 1952 was 1·9 per cent (3 deaths due to the operation, in 155 cases).

In published series the foetal mortality from external version varies from nil to 13 per cent. In a number of papers the figures given are, however, higher than the true risk of external version, as their authors include cases in which the foetus may have died from some other cause than the version.

The highest foetal mortality is usually found when anaesthesia is employed. This is exemplified by Wrigley (1934, foetal mortality 13 per cent), and Dobbie (1948; also 13 per cent but this figure was probably artificially high). The series under anaesthesia of Peel and Clayton (1948) only showed 1·7 per cent foetal mortality, however, and that of Freeth and MacVine (1951), 1·4 per cent.

Without anaesthesia a few authors have reported series in which there was no apparent foetal mortality from the operation (Ryder, 1943; Siegel and McNally, 1951; Grimes *et al.*, 1952). Donovan (1932) reported 1·25 per cent, Macafee and McClure (1937) 0·74 per cent, and Trubkowitch and Archangelsky (1944) 1·2 per cent. White and Flew (1933) reported 5 per cent but used anaesthesia in a third of the cases.

Siegel and McNally (1939) collected the results of 26 authors and found their average mortality to be 3·1 per cent. This figure is of doubtful significance, however, as many of the authorities had included all foetal deaths, and not only those actually due to version.

It seems fair to say that even in the hands of experts external version carries a foetal mortality which is not usually less than 1 per cent. It will be seen below that those who achieve lower mortality than this tend to have lower success rates than the average.

Success Rate in External Version

In reported series the success rates vary from about 45 per cent to 93 per cent.

If version is commenced early (e.g., 24–32 weeks) the percentage of successes may be very high, but the majority of these successful versions are merely anticipating the spontaneous version which would usually have occurred. If version is not commenced until the 34th week the success rate is usually lower.

It is important also to distinguish between the immediate and final success rates, because after external version about 20 per cent of successful cases will revert. Vartan (1945) had 22 per cent reversions, Newell (1941) 27 per cent, and Grimes *et al.* (1952) 20 per cent in multigravidae and 17 per cent in primigravidae. Even if patients are seen weekly a few will revert to breech and go into labour between visits.

To consider now some of the more recent series. Ryder (1943) performed version from the 6th month onwards and had 93 per cent final successes. He used anaesthesia in 5 per cent of cases. Of his 213 cases 155 were multigravidae. His success rate in primigravidae after the 7th month was only 46 per cent. It is perhaps worthy of note that on one patient 13 versions had to be performed.

Newell (1941) also performed version early (from the 28th week) and had final success in 79 per cent of primigravidae and 94 per cent of multigravidae. He used anaesthesia in 6 per cent of cases.

Trubkowitch and Archangelsky (1944) were successful in 91 per cent of cases, but the proportion of primigravidae is not stated.

Grimes *et al.* (1952), in a series of 2,251 cases, performed their versions from the 6th month onwards, and had 78 per cent successes in multigravidae, and 51 per cent in primigravidae.

Siegel and McNally (1939) collected the results of 22 authorities; version had been attempted in 1,719 cases with 1,485 successes (86 per cent). Thirty-two per cent of the patients were primigravidae. Siegel and McNally themselves were successful in 71 per cent of primigravidae and in 85 per cent of multigravidae.

Browne and Browne (1955), quoting the results of University College Hospital, state that if the legs were extended success was only obtained in 44 per cent of cases.

Using anaesthesia high success rates are possible, where version without it has failed.

Peel and Clayton (1948) had 87 per cent successes in primigravidae and 89 per cent in multigravidae. Freeth and MacVine (1951) had 78 per cent successes in primigravidae and 87 per cent in multigravidae.

The average success figure of these various authorities is 70 per cent in primigravidae and 88 per cent in multigravidae.

On the basis of the results presented, the following propositions are put forward:

(i) After the 34th week of pregnancy, in the absence of attempts at version by the obstetrician, 30 per cent of primigravid breeches and 70 per cent of multigravid breeches will turn spontaneously and be vertices at delivery.

(ii) The final success rate in external version (i.e., those cases finally delivered as vertices) is not usually greater than 70 per cent in primigravidae and 90 per cent in multigravidae.

(iii) The foetal mortality from external version is not usually less than 1 per cent, even in the hands of experts.

(iv) Breech delivery is a safe procedure provided that the cases have been properly assessed in the antenatal period; and that the patients are delivered in hospital, with an operator of reasonable experience and an anaesthetist present at every delivery. If the babies are normal and mature, the foetal mortality should certainly not exceed 3 per cent either in primigravidae or in multigravidae. In fact it should be possible to get well below this figure, to perhaps 1 or 2 per cent.

Consider now the results that are likely to be attained in 1,000 women having breech presentations at the end of the 34th week, firstly using the method described in this article, and secondly using routine external version. It is assumed that the advocates of each method deliver their breeches with the same foetal mortality; actually, it is likely that those who are delivering more breeches will achieve the lower mortality figures.

Consider primigravidae first. By relying on spontaneous cephalic version, 300 of the 1,000 babies can be expected to be delivered as vertices and 700 as breeches. Assume the mortality rate of breech delivery to be B per cent, and that of vertex delivery to be V per cent. If routine external version is not used, the total foetal mortality will be 3V+7B. Among 1,000 primigravidae with breech presentations at the 34th week treated by routine external version, there will be, from the data given previously, 700 vertex deliveries and 300 breech deliveries, and among these cases there will be 10 foetal deaths from external version. The total foetal mortality will be 7V+3B+10. Simple algebra shows that exactly similar results will be obtained by the two methods if 7V+3B+10= 3V+7B, and this equation can be simplified to V+2·5=B. That is to say, provided that the foetal mortality from primigravid breech delivery is not more than 2·5 per cent above that for normal vertex delivery, the two methods will give results that are equal. If the foetal mortality from breech delivery is less than the above figure, babies will be saved by giving up routine external version.

With multigravidae the result is even more striking if the version mortality is taken as 1 per cent. Even if it were as low as 0·5 per cent, we have 9V+1B+5=7V+3B, which can be simplified to V+2·5=B. That is to say, provided that the foetal mortality from multigravid breech delivery is not more than 2·5 per cent above the figure for normal vertex delivery, the two methods will give results that are equal. If the breech delivery mortality is less than the above figure, babies will be saved by discontinuing the practice of routine external version.

Summary and Conclusions

Results have been presented which show that with regard to babies that are presenting by the breech at the end of the 34th week of pregnancy, in 30 per cent of the primigravidae and 70 per cent of the multigravidae spontaneous cephalic version will occur, entirely in the absence of attempts at version by the obstetrician.

Results have also been given of 252 vaginal breech deliveries of normal, mature, babies in single pregnancies in hospital booked patients, in which the foetal mortality was 1·6 per cent, being 2·86 per cent in multigravidae (105 cases), and 0·68 per cent in primigravidae (147 cases).

Published series of external version and of breech delivery have been reviewed.

Calculations are made to show that, provided the foetal mortality from breech delivery in normal cases is not more than 2·5 per cent above that for normal vertex delivery, no babies will be saved by performing routine external version unless the foetal mortality from it is less than 1 per cent in primigravidae and 0·5 per cent in multigravidae while attaining a final success rate of 70 per cent in primigravidae and 90 per cent in multigravidae. Where the breech delivery mortalities are lower than the above figure, babies will be saved by discontinuing routine external version.

The suggestion is therefore put forward that in large obstetric units where experienced personnel are always at hand, the ideal treatment for breech presentation is to reserve external version for cases showing minor or moderate degrees of pelvic contraction.

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OESTROGENIC CONTROL

BY

JOHN H. MULVANY, F.A.C.S., F.R.C.S., M.R.C.P., M.R.C.O.G., M.M.S.A.

ALTHOUGH the general interdependence of the various endocrines is well known, the close connexion between the thyroid and gonads whereby the functional level of one gland is inversely influenced by the activity of the other is not so much appreciated. The reaction is indirect being governed by alteration in the output of gonadotrophin; but its occurrence is so definite and regular that there would seem to be scope for its application in gynaecological endocrinology. Not all will be familiar with the experimental work which shows so clearly the firm interlinking of the function of these two glands and it may be therefore not inappropriate to refer to a few items illustrating the effect of thyroid deprivation, and of its administration, on oestrogenic activity.

In regard to the effect of thyroid deprivation on ovarian function, it has been shown that thyroidectomy in rabbits is consistently followed by increased vascularity and enlargement due to follicular overgrowth and by loss of the ovulation reaction after coitus (Chu, 1944a, b). The change does not depend on a lowered ovarian sensitivity arising from thyroid removal as a single injection of pregnancy urine would cause the rupture of numerous follicles with formation of corpora lutea and progestational changes in the uterus. It was also noted that injection of these animals with pituitary extract from other thyroidectomized animals would not cause ovulation; nor would this reaction take place in normal oestrous rabbits injected with the same extract although otherwise occurring in at least 60 per cent with normal extract. All the thyroidectomized animals however ovulated when treated with pituitary extract from the controls. In other words, it is clear that the pituitary of thyroidectomized rabbits contains increased quantities of follicle-stimulating hormone but little, if any, of the ovulatory or luteinizing component.

The administration of thyroid extract would restore ovarian function to normal even in long-standing thyroidectomized animals and, if given shortly after the operation, would prevent the changes taking place. The inhibitory effect of thyroid administration on gonadotrophic activity, at least in respect to the follicle-stimulating hormone, is so powerful that its administration to rats can lead to a state of dioestrous after two oestrous cycles which persists for so long as the thyroid is continued (Weichert, 1930).

In regard to the effect of oestrogen on thyroid activity, there is generally a depression of function due in most part to a reduced thyrotrophic output. The reaction is sufficiently pronounced to cause a goitre induced in rats by means of a goitrogenic diet to disappear within a few weeks (Gassner, Barrett and Gustafson, 1948). Oestrogen administration would also have a marked inhibitory effect on follicular growth and maturation but the ovarian change could be completely nullified by a thyroidectomy.

These experiments demonstrate the close relationship of gonadotrophic activity to the serum level of thyroid hormone, a rise in which markedly inhibits the production of the follicle-stimulating hormone and at the same time promotes the development or operation of the luteinizing hormone. The high dosage employed experimentally can produce complete cessation of oestrus due to ovarian atrophy within a few weeks. While this degree of dosage—equivalent to about 15 gr. daily for an adult—is not possible clinically, nevertheless prolonged and steady medication on a therapeutic scale will achieve satisfactory results with complete freedom from unpleasant side-effects. The duration of treatment varies from 2 to 6 months with the exception of functional menorrhagia which may take up to 2-years continuous therapy. It may be said, of course, that the latter procedure is

somewhat tedious by comparison with the swiftness of cure by hysterectomy; nevertheless a benefit rate in the region of 85 per cent betokens surgical restraint except where the urgency of the condition or other complication requires more active measures.

Clinical Application of Oestrogenic Control

The conditions which respond to the type of gonadotrophic depression achieved by the administration of thyroid and iodine fall into two broad groups, one being connected with disorders of menstruation which include functional menorrhagia, primary congestive dysmenorrhoea, ovulatory pain and bleeding and premenstrual tension and oedema, and the other with early gestational episodes such as habitual abortion and the pregnancy headache. In all these conditions, with the exception of the last-named which is caused by intrasellar tension, it may be surmised that there is in operation an undue oestrogenic influence which experience has shown can be controlled by the simple expedient of retarding gonadotrophic activity. Improvement in the pregnancy headache results from a lessening of pituitary congestion.

(1) Functional Menorrhagia

Menstrual bleeding in the ovulatory cycle follows degeneration of the corpus luteum which leads to recessive changes in the endometrium after a preliminary build-up by combined action of oestrogen and progesterone. Regular menstrual bleeding may also occur in the absence of ovulation when it arises from endometrium which does not show the normal premenstrual growth. The phenomenon has been known since the work of Van Herwerden (1905) who demonstrated two kinds of menstruating uteri in the Java macaque, one having a narrow mucosa with resting glands and the other showing swollen mucosa with secreting glands, thick-walled vessels and the presence of a corpus luteum. It was thought that the distinction was determined by a breeding season characterized by ovulation, corpus luteum formation and progestational endometrium as a prelude to conception, and a non-breeding season in which ovulation was absent. In the human subject, anovulatory bleeding is related to a fluctuation in the oestrogen level, especially to that of a fall, and may therefore also occur after unnatural episodes such as bilateral oöphorectomy, the induction of an artificial menopause or oestrogen withdrawal.

Functional menorrhagia may be noted at three phases of life, from the onset of the flow at puberty, during adult sexual life and at the menopause. Pubertal bleeding, sometimes quite severe, may continue until about the age of 20 years and is probably connected with lack of ovulation and follicular over-secretion as many cases show varying degrees of non-secretory endometrial hyperplasia and the ovaries generally contain many little cysts without much evidence of corpus luteum formation. The cystic follicles continue to enlarge and secrete hormone so long as the intracystic pressure does not suppress activity of the granulosa cells and its accumulation subjects the endometrium to constant oestrogenic stimulation. Presumably, the correct gonadotrophic stimulus to regular ovulation and luteinization is lacking.

Excessive or irregular bleeding during the period of mature sexual life often follows a phase of heightened ovarian activity such as may be connected with marriage, childbirth, abortion or other form of psychological trauma, when it may be assumed that gonadotrophic function is temporarily disturbed; or the condition may indicate the start of metropathia due to progressive thickening of the ovarian tunica. Thyroid deficiency is an occasional cause.

At the menopause, heavy and irregular uterine loss is usually associated with overproduction of gonadotrophic hormone, especially of the follicle-stimulating component, brought about by increasing inability of the ovary to respond to stimulation. This refractoriness has been observed in subjects given gonadotrophic hormone prior to laparotomy. In 11 cases with ages ranging from 25 to 66 years, it was found that the degree of response diminished with age, there being only slight reaction in the fourth decade and none at all in the fifth or later (Watson, Smith and Kurzrok, 1938).

Treatment of Functional Menorrhagia

The forms of irregular bleeding noted above respond well to oestrogenic inhibition achieved by the administration of thyroid and iodine, a procedure completely free from additional side-effect. Before outlining the results of this therapy, it may be as well to examine the alternative forms of hormonal treatment available at present which, apart from massive oestrogen dosage, comprise either the stimulation or replacement of progesterone function or the neutralization of oestrogen by androgen.

Following the finding in rats that chorionic hormone obtained from pregnancy urine would produce marked luteinization of their ovaries, the substance was used in the treatment of menorrhagia but without great success as the luteinizing effect of this hormone in rodents is not reproduced in the human ovary nor associated with any change in the non-secretory type of endometrial hyperplasia. Later, the action of chorionic gonadotrophin was supplemented by that of pregnant mare's serum, the equine preparation being given from the fifth to the fourteenth day of the cycle and the chorionic hormone from the fifteenth to the twenty-fourth day (Hamblen and Davis, 1945). The method, however, apart from the inconvenience of 25 monthly injections, cannot be recommended, especially in pubertal bleeding, as the natural development of gonadotrophic function would tend to be inhibited and, in other forms, by the likelihood of ovarian damage from haemorrhage into and around the follicles, cytolysis of the granulosa cells and other degenerative changes. Further, the procedure disregards the well-known fact that follicular ripening, ovulation and corpus luteum formation all take place within 36 hours of its administration.

The use of progesterone (Scowen, 1944), sometimes combined with oestrogen, has had some success; but many cases fail to respond and this form of therapy has been superseded by that of androgen administration. Endometrial recession is produced by neutralization of the ovarian hormone by a substance having a specifically opposed effect. This close biological antagonism is manifested elsewhere in the ability of oestrogen to cause regression of a prostatic carcinoma and that of androgen to slow up a mammary cancer. A small percentage of patients derive permanent benefit but many require repeated or prolonged treatment. Indeed, great improvement is seldom obtained except as part of a general masculinizing effect which requires discontinuance of treatment. Further, prolonged treatment should be avoided in patients having a bad family history of cancer in view of the close chemical similarity in structure of the androgens to compounds having the tricyclic phenanthrene system.

Oestrogenic inhibition obtained by means of thyroid and iodine is practically devoid of drawback except in regard to lack of palatableness. Di-iodtyrosine is much less effective. Therapeutic progress is slow, partly because the reaction is indirect but mostly because time is needed for the absorption to take place of hormone accumulated in unruptured follicles. It is least swift in the menopausal variety of bleeding because there is additionally an over-secretion of gonadotrophin which may require considerable effort to subdue. Treatment has to be assiduous and sustained and discontinued only after the full benefit has been obtained. In the past, thyroid has often been used for menorrhagia with some degree of success but the real merit of the substance has been obscured by the empirical and haphazard fashion in which it has been employed due to lack of appreciation of the operating mechanism. The time factor is somewhat similar to that required for thyrotrophic exophthalmos treated on the same lines (Mulvany, 1944). In general, about one-third of the cases show improvement after 6-months treatment and about two-thirds by the end of a year. Another 25 per cent may be expected to improve in the second year on higher dosage.

The therapy is helpful in all varieties of functional bleeding but is of greatest value at the menopause on account of the frequency with which menorrhagia at this period comes to operation. In the case of serious pubertal bleeding, improvement may be accelerated by supplementing the thyroid and iodine administration by equine gonadotrophin given on the 14th day of the cycle and followed by three or four 25 mg. doses of progesterone spread over the following 2 weeks. Ovulation and luteinization is stimulated at the right time and the creation

of a progestational endometrium facilitated by the one measure, while the progressive development of cystic follicles, which not uncommonly predisposes to a regular heavy loss as a permanent feature, is checked both by the lessening of follicular activity and the stimulation to ovulation. In due course, under this mild form of treatment, the luteinizing element of pituitary asserts itself without the risk of follicular damage likely to be associated with the prolonged administration of stilboestrol or androgen.

Bleeding during the mature period of sexual life also responds well to oestrogenic inhibition induced by thyroid and iodine, especially when due to gonadotrophic rather than follicular derangement. Although not so severe generally as that occurring at puberty or with the menopause, it may be desirable for economic reasons to shorten the period of treatment; hence a few cases in this group had a curettage which might not have been necessary with more prolonged therapy.

17 Cases	Better in 4 Months	Better in 8 Months	Better Later	Failure
Thyroid+Iodine ..	3	7	2	–
Thyroid+Curettage	4	–	–	1

Seventeen cases in this series were treated with 1 failure which had resisted 2-years continuous therapy and 3 curettages. In this instance, the uterus was small, ovaries not palpable and the endometrium always scanty and non-secretory in character.

In regard to menopausal menorrhagia, a series of 96 cases have been treated over a period of 7 years, of which number 12 came to operation.

Number of Cases	Apparent Failures	Menopause Produced	Successes		
			Loss less than Normal	Loss Normal	Loss less but more than Normal
96	12	16	43	16	9

Of the 12 cases requiring surgical intervention, 1 had a hysterectomy performed mainly on account of dyspareunia and vaginal discharge due to chronic cervicitis. Of the remaining 11 cases, 8 had the uterus removed and in 5 of these there was a gross pathological change which excluded them from the category of functional bleeding. The abnormal pathology consisted of 2 cases of submucous fibroid, 1 of fundal fibroid, 1 with a follicular cyst about 3 inches across, and the fifth had bilateral cystic ovaries. The other 3 cases showed no obvious cause for the bleeding, but microscopy revealed in 1 a good deal of fibrosis with muscle atrophy. The last 2 cases consisted apparently of a normal uterus and ovaries. Curettage was carried out 3 times on account of excessive loss requiring early relief; but the measure does not appear to shorten the duration of treatment in the menopausal menorrhagia. Corrected figures for the series are as follows:

Number of Cases	Failures	Menopause Produced	Successes		
			Loss less than Normal	Loss Normal	Loss less but more than Normal
90	7	16	43	16	9

Endometrial biopsy before and after treatment (Figs. 1–4) show changes sometimes suggestive of a return of progestational activity and at others varying grades of hypoactivity especially when the menopause has been produced. About half the cases however show no detectable change. The series also included a few instances of slight fibroid formation, treatment having been tried partly on account of the patient's wish to avoid operation and partly from interest. The impression was gained that the fibroid unless submucous was of less importance than the associated endocrinal disturbance. Patients under 45 years of age tended to require longer periods of treatment but even in younger patients dramatic effects were sometimes obtained after only a few months' treatment. Medication consisted of Lugol's iodine, 20 drops twice daily in 2–3 ounces of milk preferably after food, and one grain of thyroid taken anytime. When improvement was only slight

after 6- to 8-months therapy, the dose of thyroid was raised to 2 grains daily and at the end of 12 months to 3 grains in obstinate cases, the dose of iodine remaining unchanged. When the clinical condition was satisfactory or stationary after some improvement, dosage was reduced progressively over a few months so that the total course in some cases occupied nearly 2 years.

(2) Primary Congestive Dysmenorrhoea

The grouping of primary dysmenorrhoea into congestive and spasmodic varieties is convenient in that the mechanism involved in each type being different, therapy requires also to be distinct. The frequency of each type occurring separately is about 35 per cent, the two syndromes being found together in the remainder. At present, it would seem that treatment is not very satisfactory for the congestive type of pain. In 1936, Falls and associates reported a 50 per cent success from the use of progesterone, and other claims have followed, although the circumstance is odd in view of the suggestion that severe dysmenorrhoea does not occur in the absence of a secretory endometrium (Hamblen, 1945), of the fact that pain is not a feature of metropathia and of the finding that uterine contractions increase progressively in force and frequency during the progestational phase of the menstrual cycle achieving maximal intensity in early menstruation (Moir, 1933–34). In 1939, testosterone was used in large dosage up to 900 mg. per cycle by Salmon, Geist and Walter and in small doses of only 5 mg. given 2 or 3 times monthly by Rubinstein and Abarbanel. Oestrogen in dosage sufficient to prevent ovulation is also favoured on the basis of the observation by Clow (1927) that dysmenorrhoea is not seen in the first two or three years of menstruation when the bleeding is anovular and the later suggestion of Sturgis and Albright (1940) that pain is found only with the ovulatory cycle.

Good results are claimed for all these methods although there is often no indication as to the type of dysmenorrhoea present. Certain disadvantages however attach to each procedure, with progesterone on account of unreliability and the need for parenteral administration, with androgen by reason of masculinism and the possibility of ovarian atrophy, and with oestrogen because the regular suppression of ovulation is likely to produce follicular cystic ovaries resulting perhaps in infertility or other menstrual disorders. On the other hand, in regard solely to congestive dysmenorrhoea, a most effective remedy without any of the above drawbacks is available in Lugol's iodine, 20 drops twice daily. Improvement sometimes occurs after only one month's treatment and is usual by the end of the second; but generally the patient is free from pain—or has less than an hour's discomfort—between the fourth and sixth periods. The mechanism of relief is simple, arising from a lessening of follicular activity which in turn reduces uterine congestion. The following case which was the first in the series to be treated may be taken as illustrative:

J.H., aet. 25, had a severe and increasing congestive dysmenorrhoea which had reached a peak of 6-days continuous pain. Starting 4 days before the menstrual flow and lasting 2 days further, the pain was so severe that the patient lost the best part of a week's work each month. Absolute constipation was present from the start of the pain until third day of the period and there was vomiting on the first day. Within 8 weeks of commencing treatment, the pain was reduced to 4-hours duration and within 4 months to a mere half-hour's discomfort. Therapy was stopped after 14 months and the patient, seen twice yearly for 4 years, remained free from pain.

Correct diagnosis is necessary as the treatment is useless for spasmodic dysmenorrhoea. The congestive pain is generally recognizable by its persistence and aching character, with periods of variable intensity, starting before the onset of the flow and located in the hypogastrium with occasional reference to the outer thigh regions. In a series of 21 cases, 17 were cured of their pain within 6 months and 2 others, slow to improve, got well on the addition of one grain of thyroid daily. Of these patients, one, seemingly having both congestive and spasmodic features, derived benefit in both respects. There were 2 failures in the series. A few instances of secondary dysmenorrhoea were also treated and the pain improved for a time; but the presence of chronic inflammation seems to nullify any prolonged relief.

(3) Ovulatory Pain and Bleeding

Intermenstrual pain occurring about the time of ovulation was noticed as long ago as 1847 by

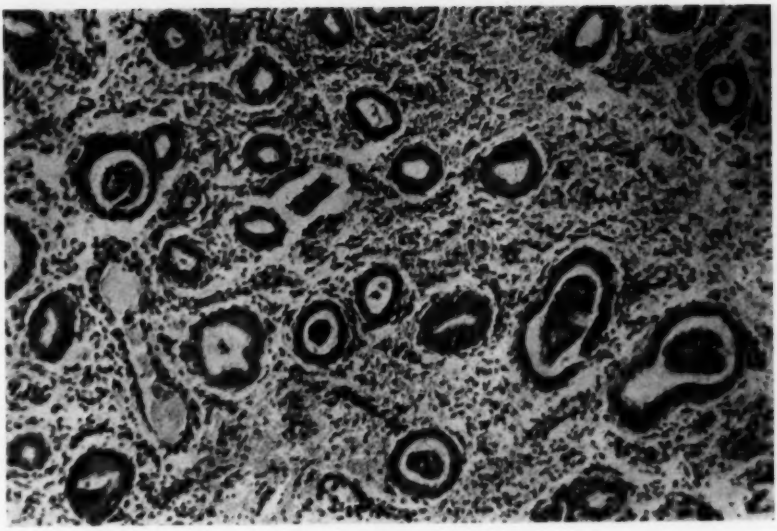

FIG. 1

G.B., aged 44: Continuous bleeding for 12 weeks when biopsy was taken. Non-secretory hyperplasia of endometrium. Epithelium thick suggestive of pseudostratification. Stromal cells rather fibrotic. ×40.

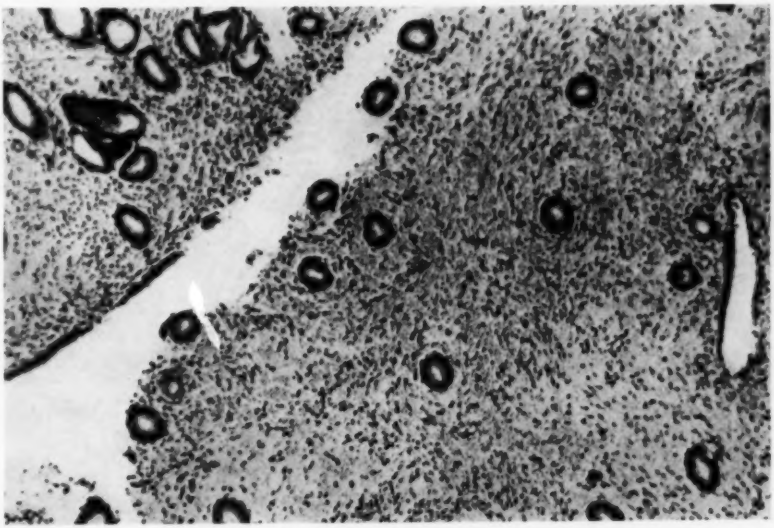

FIG. 2

G.B.: After only 6 months treatment, periods regular with normal loss. Endometrium now shows proliferation with secretory changes. ×40.

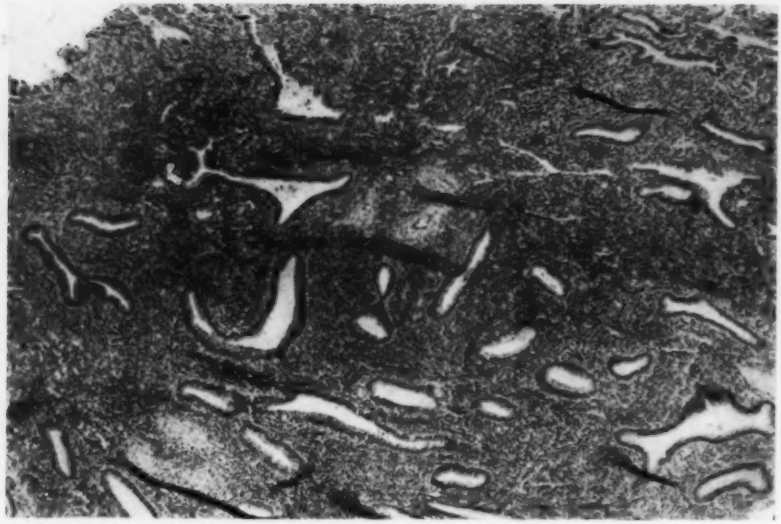

FIG. 3

D.P., aged 42: 8-months heavy irregular bleeding lasting 10 days. Biopsy 6 days before date of expected period. Endometrium non-secretory in early proliferative stage. Glands slightly tortuous but no secretory activity. ×72.

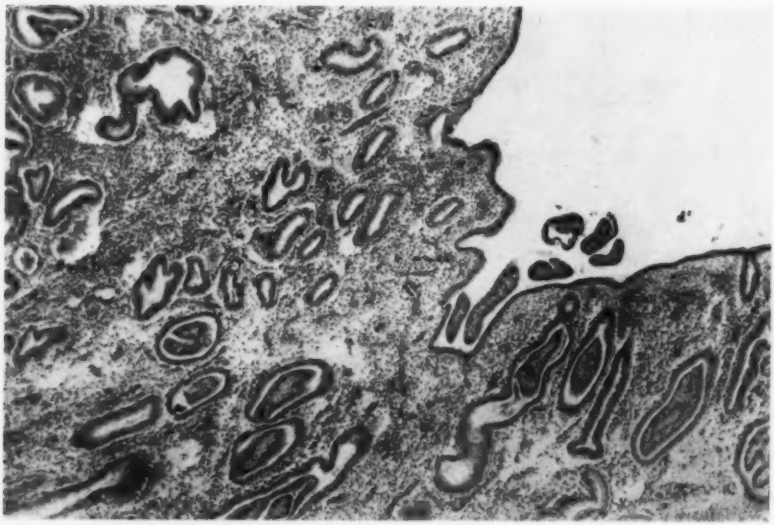

FIG. 4

D.P.: Biopsy after 12-months treatment. Early secretory changes present but glands are suggestive of hypoactivity. Menstruation was reduced to 3–4 days with light loss occurring about every second month. ×72.

J.H.M.

Pouchet who thought it was caused by contraction of the tubes in an effort to propel the ovum toward the uterus. It is now agreed that intermenstrual pain is related to ovulation and at 30 laparotomies for acute lower abdominal pain in which the tubes and appendix were normal, Wharton and Henriksen (1936) found evidence of recent ovulation in 9. The pain is presumably connected with high intrafollicular tension and the effects of rupture. About this time bleeding may also occur, being related probably to the sudden release of oestrogen and associated changes in the blood level of this hormone. Both conditions are harmless but as each is easily curable with iodine, there is no point in leaving them untreated. In regard to ovulatory pain, of 12 cases treated, 2 had no recurrence after 4 weeks treatment and 4 others were free after the second month. Of the remaining 6 patients, 4 were cured and 2 improved after further treatment. Of 9 instances of ovulatory bleeding, 6 were better after 3-months treatment and 2 others after the sixth period. The remaining case continued to have bleeding but only intermittently.

(4) Premenstrual Oedema and Premenstrual Tension

In regard to premenstrual oedema, Thorn and associates (1938) showed that the injection of oestrone, progesterone, pregnanediol and testosterone into dogs would induce the retention of sodium chloride and water and demonstrated in human subjects that premenstrual oedema was also associated with retention of these substances and the onset of menstruation with an increased excretion. The influence of the sex hormones on water metabolism is illustrated by the swelling of the capon's comb, due mainly to increased fluid content, in response to androgen and the perineal oedema of the female monkey which may spread to the muscles of the back produced by oestrogen. The mechanism of the menstrual electrolytic change is not fully understood; but since the menstrual phase of increased retention coincides with the period of rise and fall in progesterone and oestrogen function, it is not impossible that the degree of premenstrual oedema might be influenced by a modification of this activity. Instances of premenstrual oedema are not very common but the impression has been gained that the administration of thyroid and iodine is definitely helpful in lessening the facial swelling which at times may prove a considerable embarrassment.

In regard to premenstrual tension, the psychological and nervous phenomena preceding menstruation, quite a number of women experience minor degrees of nervous irritability which are accepted as normal and unavoidable. A small proportion however show a noticeable increase in nervous tension with underlying anxiety features displayed especially by instability of the vegetative nervous system. Some of these features comprise items such as tremor, restlessness, polyuria, frequency, loss of appetite, nausea, attacks of vomiting and diarrhoea, excessive sweating of the palms, feeling of respiratory embarrassment, precordial distress, vasomotor upset and numerous other symptoms referable to various systems. These features suggest a mild anxiety phase or sympatheticotonia of the type similar to that occurring as an essential part of the thyrotoxic syndrome in which overaction of the sympathetic system operates alongside hyperthyroidism. The synergistic interaction of the suprarenal and thyroid hormones is well known, simple illustrations being the dilatation of the pupil in a thyrotoxic patient after instillation of adrenalin into the conjunctival sac (Loewi, 1921) or the production of proptosis in the dog on ephedrine by an injection of thyroxine (Labbé, 1931). In thyrotoxicosis, the vicious circle is broken only by elimination of thyroid overactivity.

With regard to premenstrual tension, a constitutional background may be suspected, having superimposed items of minor stress, such as worry, fatigue, which is raised periodically to a state of patent sympatheticotonia by the mild transient rise in thyroid activity inseparable from the menstrual phase. Assuming this to be correct, benefit might be expected from a lessening of this cyclical thyroid activity and experience has shown that the damping down of thyrotrophic secretion by a course of thyroid and iodine is able to create sustained improvement after 4- to 6-months treatment. The apparent paradox lying in the administration of thyroid is found in the greater thyrotrophic-inhibiting

property of thyroxine. The treatment produces sufficient thyroid depression to check the periodic rise in vegetative nervous irritability and the relief obtained seems lasting and more natural than that from other means.

(5) Pregnancy Headache

It would seem at present that recognition of a type of headache arising specifically from pregnancy, characteristic in duration, time of onset and form, is not general. The condition may be noticed in about 2 per cent of pregnancies and more often in primigravidae. Appearing between the fifth and eighth weeks, occasionally as early as the fourth, it persists as a constant and unrelieved feature until about the eighteenth week when it generally disappears spontaneously. Sometimes, the headache will start about the twenty-eighth week, or may recur about then, and rarely it may continue throughout gestation when it vanishes within 24 hours of parturition. Characteristic thus in time of onset, duration and persistence, the location and form are equally distinctive. It appears as a low frontal or retro-orbital ache extending laterally into the adjacent temporal areas and is of a dull, boring nature which, although not of migrainous or neuralgic severity, is sufficiently bad to require relief. The protracted disposition of the headache gives rise to lassitude and depression, due partly to disturbed rest.

The location and character of the headache is suggestive of increased intrasellar tension which, it may be supposed, is related to the rapid expansion in activity of the pituitary gland normal in the early weeks of gestation. Failure to accommodate this enlargement smoothly is likely to give rise to local congestion and headache until after the third month when the hypertrophy of the gland tails off and tension is lessened. It is interesting to note that the trouble does not usually recur in later pregnancies but may nevertheless appear for the first time in a third or fourth gravida. Skiagrams of the pituitary fossa show in most cases a normal-sized cavity so that the headache would seem to arise from an undue sensitiveness of the hypophysis to early gestational stimulation on a particular occasion.

The pregnancy headache should not be confused with other types occurring coincidently in early gestation. Common forms comprise the dull frontal ketotic headache due to glycogenic imbalance and the throbbing one associated with frequent vomiting. Another type, occipito-cervical in position with characteristic radiation to the nape of the neck, may appear in the middle third of pregnancy, being more common in the elderly primigravida and related possibly to ovarian dysfunction as a similar sort is not infrequent at the menopause. Again, there is encountered the headache due to worry or anxiety, usually vertical or occipital in position, or in both places at once, varied sometimes by a sensation of a tight band around the head. Usually present before conception in association with other anxiety features, it is considerably aggravated by the pregnancy. Other forms of headache which may become prominent during gestation are the hemicranial type due to migraine, the auriculo-temporal resulting from dental caries, the maxillary or low frontal ache due to sinusitis, the throbbing headache of vasomotor instability and that due to constipation. Lastly, cerebral tumour should be considered when the headache and vomiting assume unusual characteristics. Although uncommon, it is not so rare but that the writer encountered 2 cases within 18 months. In each, pregnancy had occurred before symptoms of the cerebral lesion were manifest but headache with vomiting and papilloedema were prominent by the end of the third month. Slight jargon aphasia with fits developed in one and the other produced a slight right-sided facial weakness with hallucinations of smell. Improvement was rapid after hysterotomy and X-ray radiation, being accelerated by the withdrawal of the large quantities of growth hormone circulated in early gestation. One case however relapsed after a year and died, and the other, although completely hairless across the vertex, was still symptom-free when last seen, the infant being then 10 months.

The treatment of pregnancy headache consists of the administration of 20 drops of Lugol's iodine twice daily, the effect being to relieve intrasellar tension by reducing pituitary activity. In general, relief is obtained within 4 days and sometimes in 48 hours. About one-third of the

cases take up to 10 days and in a few instances the headache is not completely removed although the improvement is substantial enough for the subject to be dropped by the patient. Over 70 cases of pregnancy have been treated with only 2 complete failures, 1 of these being in a hypothyroid patient who had been on 3 grains of thyroid daily for 3 years. Possibly, the pituitary gland, inured to the use of thyroid, was insensitive also to iodine. Raising the dose of thyroid by another grain had no effect on the headache which passed off gradually in the fifth month of gestation.

(6) HABITUAL ABORTION

Although 1 pregnancy out of 6 is stated to end in abortion, the cause is not often elucidated; but in practice there are probably only two factors of importance, namely, embryological abnormality and imperfect nidation of the fertilized ovum. Developmental abnormality of some degree is said to occur in nearly half of the embryos aborted in the first 3 months of gestation and may be responsible for many instances of non-recurrent abortion. In connexion with habitual abortion however this factor is probably of less significance than interference with normal implantation as may be judged from the circumstance that the habitual aborteuse, when successful in carrying to term, does not generally produce an abnormal infant nor, on the other hand, is the woman who successively reproduces a congenital deformity prone to frequent abortion. Embryological abnormality incompatible with life may be an important cause of abortion but there is little evidence to suggest that this factor has great aetiological significance in respect to the repeated interruption of pregnancy.

The more important item in regard to habitual loss of the fertilized ovum is probably a shallow implantation due to the unfavourable state of the endometrium at the moment of conception. A hyperplastic non-secretory lining resulting from hyper-oestrinization or defective luteinization, poor in glycogen and tending to interstitial haemorrhage, is resistant to a satisfactory penetration by the embryological sac. As a result there follows trophoblastic underdevelopment and subnormal production of chorionic gonadotrophin; with the consequence that the corpus luteum fails to attain full measure of growth and suffers thereby an impairment of functional efficiency which may be sufficient to take it below the level required to maintain pregnancy when the great drop in output of chorionic gonadotrophin from recession of the chorion frondosum takes place. The cause of habitual abortion lies less with the failure of transfer of function from the corpus luteum to the placenta, as is commonly stated, than with a primary insufficiency of the corpus which manifests itself acutely on withdrawal of maximum chorionic stimulation.

The effect of oestrogen excess at the start of pregnancy is clearly seen from the experimental finding in many animals that an injection of this hormone within a few days of conception will invariably lead to abortion. After implantation, it is more difficult to unseat the ovum, larger doses being required in proportion to the age of the embryo up to a period of some days after which the substance becomes ineffective. In women, some authorities doubt the effect of oestrogen excess, particularly in view of the finding by Robinson and associates (1935) in a series of 12 cases of early pregnancy requiring termination that doses of oestrogen up to 1 million units were unable to produce abortion. No pregnancy however was earlier than 6 weeks and the only justifiable conclusion is that at this period of gestation, or later, a normally implanted ovum is able to resist a very powerful oestrogenic attack. The behaviour of the human ovum is therefore exactly comparable to that of the experimental animal after a similar period of foetal life and there is no evidence that an equivalent dosage, if given shortly after or before conception, would not have the same effect in the human subject as in the experimental animal.

The importance of a properly functioning corpus luteum at the start of pregnancy was demonstrated by Corner and Allen (1929). The observers found in rabbits that ovulation and entrance of the ova into the tubes takes place about 10 hours after mating. The first segmentation occurs about the end of the first day, the development of the blastocyst about the third day and implantation usually on the eighth.

Bilateral oöphorectomy was performed 14–18 hours after mating—when the ova had been in the tubes some hours—and the animal autopsied between the fourth and eighth days. In each case, the blastocyst had reached the uterus but was degenerate and there was no associated endometrial proliferation. Removal of all ovarian tissue except the small portion bearing the corpus luteum did not interfere with normal implantation and development. In the human subject, bilateral oöphorectomy in early pregnancy is also very likely to be followed by abortion although Adsell (1928) collected 22 cases of castration within the first 3 months with only 2 abortions. The small number of interrupted pregnancies recorded may have been due to the circumstance that it was the continuance of gestation which was of interest and the possibility of accessory ovarian tissue—found in 4 per cent of women—cannot be discounted.

It may be accepted that the fate of the fertilized ovum, for safe keeping or loss, is decided within the first few days of its existence so that the treatment of habitual abortion should start when possible with the ovulation prior to conception. Lutein insufficiency should be assumed and anticipated by gonadotrophic stimulation directed to adequate corpus luteum formation and by progesterone administration to secure a progestational endometrium. The habitual aborteuse is generally readily fertile and the following procedure is recommended in such instances. When a decision to try again for a pregnancy is made, the patient receives an injection of 400–1,000 units of serum gonadotrophin the day prior to ovulation in order to stimulate its occurrence and subsequent luteinization. Twenty-five mg. progesterone are next given on the 18th, 22nd and 26th days of the cycle in the hope of forcing a progestational endometrium conducive to proper nidation. Should pregnancy follow, the hormone is continued in reducing dosage until the end of the fourth month when the placenta may be expected to be producing normal supplies. It is considered that this plan will favour an adequate implantation of the ovum and trophoblastic development and minimize the critical phase of gestation caused by the drop in output of chorionic gonadotrophin preceding the take-over of progesterone function by the placenta. Seven cases only have been treated to date by this method, three having had 3 previous abortions, 1 also having produced a live infant, and the remaining four 2 abortions without live issue. Two patients conceived at the first attempt, 5 have been safely delivered and 2 are still carrying but past the critical phase.

For the treatment of habitual abortion after conception, the administration of progesterone has claims of success varying from 50 to 90 per cent. Implantation of this hormone has found favour although doubt may be felt in regard to its true value in view of the circumstance that, when placed in a superficial muscle like the rectus abdominis, the implant can often be felt unchanged in size for several months. The rate of absorption thus may be extremely slow and the daily dosage probably too small to influence substantially a well-developed endometrial hyper-oestrinization.

An alternative method having as good results as any published follows the simple depression of oestrogenic function by the use of Lugol's iodine, 20 drops twice daily. A series of 22 cases, having had 2 or more previous abortions, has been treated and the findings compared with

Malpas (1938)		McGregor and Stewart (1939)				Mulvany				
Previous Abortion	Chance of Full-time Per cent	No. of Cases	No. of Children	Full-time	Abortion	No. of Cases	No. of Children	Full-time	Abortion	Death *in utero*
2	47	9	Not	6	3	16	12	14	1	1
3	14	9	Given	7	2	4	1	2	1	1
4	3	4		1	3	—	—	—	—	—
5	—	—		—	—	2	0	2	0	0

those of McGregor and Stewart (1939) in a similar group treated with progesterone.

It will be seen that the results in the two series are comparable although there were only 2 abortions and 2 deaths *in utero* as against 8 abortions in the earlier one. Attention may also be drawn to 2 cases in the series who had had 5 previous abortions without antecedent live issue, one of these being also a chronic asthmatic. In regard to the 2 deaths *in utero*, occurring about the 22nd and 24th weeks respectively, it became apparent after cessation of foetal movement and a decline in the size of the uterus that foetal death had taken place. Treatment with iodine was continued for a further 4 weeks during which period the foetuses were retained in the uterus. On discontinuing the iodine, spontaneous abortion followed within 3 days.

Satisfactory as may be the results of the series. further improvement might have been obtained by the coincident administration of thyroid and/or progesterone, although the cause of foetal death was not elucidated. The investigation however was carried out solely in respect to the value of iodine alone, neither thyroid, progesterone, barbiturate nor any other form of medication being given nor the employment of what might be termed useful adjuncts such as the abstention from sexual intercourse or rest in bed at the critical phase.

The administration of iodine is also of value in the prevention of premature labour. It is known of course that the previous occurrence of this event is quite likely to be followed by a full-time delivery; but the impression has been gained, in view of the circumstance that 5 out of 8 patients who had had previously 2 premature labours went over term, that the method is of advantage in deferring a premature onset of labour. Treatment should start at the 28th week and continue until term with the routine dosage of 20 drops twice daily.

Summary

Based on experimental evidence and clinical observation, a means of oestrogenic control by the administration of iodine and thyroid is presented which is of value in the treatment of certain obstetrical and gynaecological states having a logical basis for retardation of this endocrinal function. Working indirectly through the pituitary gland, the method restricts oestrogenic activity by reducing the output of the follicular-stimulating hormone. Study of the process has extended over 7 years.

Experimental evidence is submitted which demonstrates the strong oestrogenic-depressant effect achieved by the administration of these substances.

Oestrogenic control is of value in the treatment of functional menorrhagia, primary congestive dysmenorrhoea, ovulatory pain and bleeding, premenstrual oedema and premenstrual tension and habitual abortion. The mechanism of pituitary depression produced by the procedure is also effective in curing the pregnancy headache which arises in the early weeks of gestation in about 2 per cent of patients, being occasioned by undue swelling and congestion of the gland resulting from an excessive response to stimulation by chorionic gonadotrophin.

Concerning functional menorrhagia, the slowing-up of follicular activity enables the absorption to take place of oestrogen accumulated in unruptured follicles which is responsible for endometrial hyper-oestrinization. Of 90 cases, 6 only came to operation, a hysterectomy being performed in 3, and the menopause was produced in 16; while of the remainder, two-thirds were left with a loss less than normal.

In regard to primary congestive dysmenorrhoea, relief is probably related to a reduction of ovarian and uterine congestion secondary to lessening of follicular activity. The proportion of success is high, about 90 per cent, but correct diagnosis is necessary as the method is valueless for the spasmodic or secondary congestive variety of dysmenorrhoea.

Ovulatory pain and bleeding also respond satisfactorily, the excessive follicular tension which is the cause of the pain and the oestrogen fluctuation which results in bleeding both being sufficiently controlled to cause the disappearance of the symptoms.

Benefit is obtained in premenstrual oedema and premenstrual tension, in the former by influencing the mechanism of menstrual electrolytic change linked to oestrogen and progesterone function and in the latter by curb-

ing the cyclical surge of thyrotrophic activity which is linked to the periodic tendency to sympatheticotonia.

In connexion with habitual abortion, oestrogenic depression favours the freer operation of the corpus luteum and has produced results equal to the best obtained by other means. In addition, a procedure is described for the treatment of this condition before conception based on the assumption that it is caused by a primary insufficiency of the corpus luteum resulting from poor trophoblastic development secondary to shallow implantation of the fertilized ovum. Thus is avoided the critical phase preceding the take-over of progesterone function by the placenta which arises from the impact of a rapid drop in output of chorionic gonadotrophin on a subnormally functioning corpus luteum whereby the activity of this body falls below the level required to maintain pregnancy.

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DILATATION OF THE CERVIX UTERI—A MODIFIED TECHNIQUE*

BY

DR. A. HURTIG

Assistant Professor of Gynecology
University of Ottawa

Gynecologist
Ottawa General Hospital, Ottawa, Ontario, Canada

DILATATION of the cervix uteri is the commonest universal gynaecological operation. It is performed most often in a manner first described by Hegar in 1881 with instruments devised by him at that time.

The solid Hegar dilators have certain proven disadvantages. Bacteria from the infected cervix may be forced into the lymphatics and blood stream, and *viâ* the fundus into the Fallopian tubes and peritoneum (Crossen and Crossen, 1948). Viable endometrium can be forced through the tubes to cause endometriosis (Sampson, 1940). Blood in the fundus is forced into the open tubes and by the formation of clot may cause partial or complete tubal obstruction. In instances where the fundus contains fluid, the working end of the dilator becomes a hydraulic ram with escape valves only at the 1 mm. isthmus of the tubes or open veins and lymphatics. The consequences of this fluid containing pus, endometrium or neoplasm are obvious (Shaw, 1954). Unsuspected carcinoma of the fundus, by increase in intra-luminary pressure, is spread intra-peritoneally, intravascularly and into the lymphatics by the very act that tries to diagnose and treat the condition.

In one series of 325 ectopic pregnancies, 56 per cent had had one or more dilatations and curettages prior to the tubal pregnancies (Asherman, 1955). Perhaps some defects in our accepted procedures are at fault.

In 1955 the single-handed type of Hegar dilator was re-designed at my request with the aid of Mr. H. Woodhall of Allen & Hanburys Ltd., of London, England, for use in the Gynecology Department of the Ottawa General Hospital and University of Ottawa School of Medicine (Hurtig, 1956). The modifications included:

(1) A constant size cannula the whole length of each dilator.

(2) A Luer-lock at the proximal end.

(3) A specimen collector to fit to the Luer-lock and which itself was attached to the standard operating room suction.

(4) Interchangeable transparent plastic bottles which screwed into the specimen collector.

(5) Graduation lengthwise of all the dilators in one-half centimetres.

The primary purpose of these modifications was to apply a very strong vacuum or head of negative pressure at the penetrating tip of the dilating instruments, and simultaneously to trap loose bacteria, cancer tissue and endometrium to prevent their spread and for careful study.

The continuous suction prevents dissemination of bacteria, endometrium or malignant cells in any direction except along the cannula into the bottle. Material obtained can be watched continuously in the plastic container. The appearance of abnormal tissue, pus or blood is detected at once and the source accurately pinpointed by consulting the measurements on all the cannulas. Thus "serial suctionings" can be made as the cannula is slowly introduced. "Single target suctionings" at the Fallopian isthmus are possible in suspected cases of tuberculous salpingitis. The cervical canal

* Presented to the Ottawa Academy of Medicine, at the Ottawa General Hospital, 18th November, 1955.

remains free of debris, blood and clot and an excellent view of the endocervix is possible on withdrawing the largest dilator. Dilatation of nulliparous cervices is very much easier than with any other method.

Technique

Two ml. of sodium citrate (4 per cent) are placed in the bottom of each bottle.

The patient is prepared in the usual manner, painted, draped, catheterized and re-examined. The standard operating room suction tube is fitted to the proximal end of the nozzle on the proximal side of the specimen bottle. Grasping the entire instrument at the bottle in the same light manner as one would hold a pen and resting the middle, ring and little finger about the bottle lightly, as on a pistol-grip (Fig. 1), the surface of the cervix and endocervix is "vacuum cleaned".

The holding fingers need not be clenched. Very little force is needed to insert a size 5 dilator into a nulliparous cervix. Progressive sizes are definitely easier to insert than the solid variety. Bottle No. 1 is removed, labelled and the material sent for culture, antibiotic sensitivity and pathological examination. It is important that the bottles be held erect while the suction is on or the material obtained may disappear up the rubber tube.

The second bottle is attached and the smallest cannula slowly introduced. No force is needed. The cannulas are attached to the specimen bottle by an 180° turn. If the uterus is retroverted, they are attached pointing upwards at first; the locking turn will direct the point posteriorly. The bottle is always held vertically. As the cannula is introduced, the bottle is watched. Endometrium will often appear at once. The measurements are watched for precise location of abnormal material. The lengths of the cervical and uterine canals are noted. Under no circumstances will the larger dilators be allowed to penetrate farther than this measurement. It is usually possible to twist the tip of the cannula into the cornu and obtain specimens from there as well.

Suction is then stopped, the bottle removed and labelled and the cannula now used to feel the interior of the uterus as "a blind man uses a cane". Continuous suction at this point will disturb the sense of feel completely.

A third bottle is now attached and progressively larger dilators are used to enlarge the cervical canal with continuous suction. This is accomplished with much less force and tearing and bleeding than with the solid dilators. As each dilator is removed, the endocervix is watched for abnormalities and a good view is usually obtained. With practice, it takes no

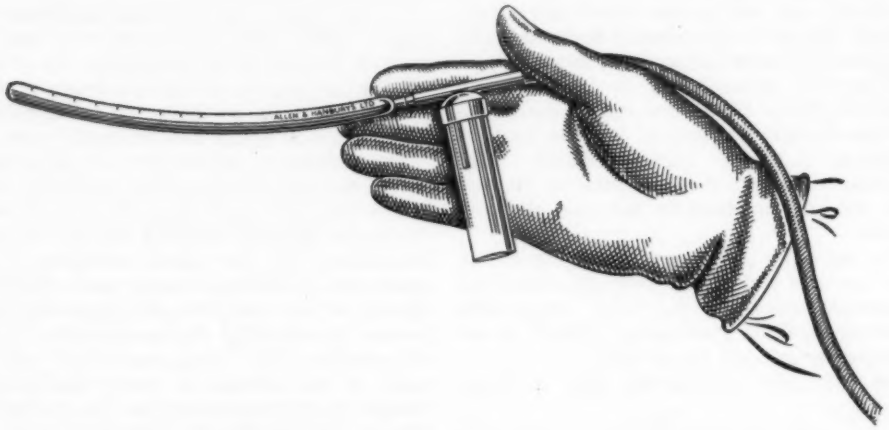

Fig. 1

more than 5 seconds to change dilators on the specimen collector, and the same time for changing bottles.

Unless large amounts of material or blood are obtained, the third bottle can be used for the remainder of the dilatation before curettage which is done in the usual manner. It cannot be emphasized too strongly that the specimen collector is not designed to replace use of the standard curette.

If cervical biopsy or amputation is to be performed, the specimen bottle is removed and the largest cannula attached direct to the suction. It is thus used to keep the field free of blood and clot.

Large pieces of endometrium or small polyps will often plug the cannulas or the specimen collector. This plug can always be cleared by reversing the collector on the suction tube for a few seconds. If the suction used is too strong, the material in the bottle will tend to "boil" and disappear into the main system. Vacuum pressure should be reduced accordingly.

After completion of the procedure the larger cannula is re-introduced into the fundus to remove all debris and clot remaining.

The smallest cannula is an excellent instrument for safely obtaining pus from an infected uterus, but perforation is a definite hazard.

Where power suction is not available, a 20 ml. syringe will give some of the suction necessary to accomplish everything described above; it is not nearly as effective, but it is still superior to the use of the solid dilator.

The "suckings" from bottles 1, 2 and 3 are cultured where indicated. The endometrial specimens obtained are actual pieces of tissue and not merely cells and can be thus sent direct to the laboratory, untouched and uncrushed, and not mixed with blood, gauze and clot. These specimens exceed curettings in quality and clarity by far—but not, of course, in quantity.

Another routine we have used is as follows: filter papers are numbered and placed over open jars and the contents poured separately on to individual papers. Before the residue is allowed to dry, it is removed and placed in separate numbered bottles of formalin. If the residue is small, that piece of filter paper is excised and dropped into formalin and the whole specimen sectioned.

The pathologists are able to identify material obtained by "suctioning" and are interested in examining "serial suctions". This has been one of the happiest surprises of the entire procedure and much further study is being done in this direction.

Summary

(1) Solid Hegar dilators, by increasing local and intra-uterine pressure, can spread viable endometrium, bacteria and neoplastic cells *viâ* the Fallopian tubes into the peritoneal cavity, and *viâ* the lymphatics and veins to the pelvis and farther.

(2) The instrument of diagnosis thus spreads the disease it seeks.

(3) A modification of the Hegar dilator is presented which substitutes a strong head of negative pressure at the vulnerable areas by power suction through cannulas bored in all the dilators.

(4) A transparent specimen collector incorporated into the system offers an additional aid to the pathologists' problem of obtaining legible material.

(5) The new technique used is presented in detail.

I would like to thank Drs. A. L. Richard, A. J. J. Nuyens, D. H. Rea, H. de St. Victor and A. Larocque who also used these instruments on their patients and offered constructive criticisms. I would also like to thank Dr. D. Magner and Dr. J. S. Campbell of the Pathology Department, who suggested the routines to be used for tissue preservation and study and who spent considerable time going over the extra tissue obtained.

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"HEXAMETHONIUM LUNG"

Report of a Case Associated with Pregnancy

BY

W. WALLACE PARK, M.B., Ch.B.

AND

F. J. COCKERSOLE, M.R.C.O.G., M.M.S.A.

From the Department of Obstetrics and Gynaecology, Kingston Hospital, Kingston-upon-Thames and the Department of Pathology, Queen's College (University of St. Andrews), Dundee

IN recent years the use of hypotensive drugs has attracted increasing attention. A number of such agents are now widely used in the treatment of hypertensive disease associated with pregnancy.

The present case is reported to show that such therapy may not always be free of danger to the mother, and to draw attention to an unusual fibrosis occurring in the lungs of some cases under treatment with drugs of the hexamethonium series.

The condition was first described in 1954 by Doniach, Morrison and Steiner in the lungs of 3 out of 54 patients undergoing treatment with hexamethonium bromide for hypertensive disease. Two of these died, one after 7 months, the other after 12 months of treatment. The third patient, 2 years after the start of therapy, was able to resume work. All 3 patients had shown radiological evidence of pulmonary oedema ("bat's wing" or "butterfly" shadowing) at some time during their illness. The lungs of the 2 fatal cases showed at necropsy wide areas of translucent appearance and firm, rubbery consistency, and, histologically, fibrinous pulmonary oedema with widespread patchy fibrosis. Similar lesions were seen by Morrow, Schroeder and Perry (1953) in 5 out of 37 patients who died during or shortly after the cessation of therapy, in a total series of 258 patients treated with a combined hydrazinophthalazine and hexamethonium regime. How many of the 37 fatal cases came to necropsy is not stated. The lesion in their cases, designated "interstitial pneumonia", may have been the same as that described by Doniach *et al.* but no pathological details are included in the report. A rather similar example is described by Robillard *et al.* (1955) of a patient who died in uraemic coma, the lungs showing fluid exudate and "early fibrosis" in the interstitial tissue but no fibrin or fibrous tissue within the alveoli.

A further instance of this condition, occurring during pregnancy and characterized by prominent intra-alveolar fibrin and fibrous tissue, is now reported.

CLINICAL DATA

The patient, aged 37, was expecting her eighth child. She had previously been delivered normally of 7 living infants at term, whose birth weights ranged between 7½ pounds (3·30 Kg.) and 8 pounds (3·63 Kg.). Hyperemesis gravidarum in varying degree occurred early in each pregnancy. Following the fourth pregnancy there was an attack of "phlebitis".

The sixth pregnancy is the first for which accurate details are available. Labour was induced surgically at term, and was followed by the delivery of a 7 pound 9 ounce (3·43 Kg.) male infant, after a 4-hour labour. Thrombophlebitis affecting the deep veins of the right leg was diagnosed on the seventh day after delivery. There was no hypertension noted at any time during this pregnancy or in the puerperium.

Early in the seventh pregnancy, in 1949, the patient was admitted to hospital with excessive vomiting. The blood pressure was 160/100 and remained raised despite rest. Renal function tests at this time showed normal results. Albuminuria developed at 36 weeks and labour was again induced surgically. A male infant of 7 pounds 4 ounces (3·2 Kg.) was delivered, after a 2-hour labour the same day. Two months after delivery the blood pressure was 150/96 and a trace of albumen was present in the urine.

The patient is said to have had an attack of pneumonia following this pregnancy but we have been unable to obtain any details about this illness.

The patient came under our care in January, 1952 when

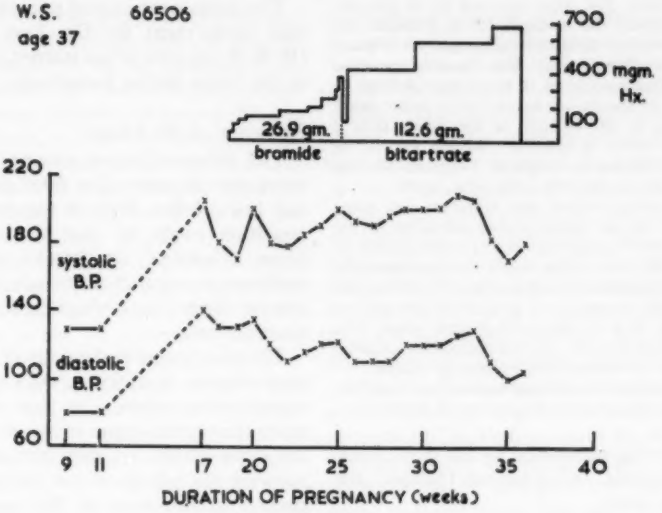

FIG. 1

The chart shows the fluctuations in blood pressure and the dosage of hexamethonium. The blood pressure was maintained at levels around 180/110 only by a steady increase in dosage.

she was 8-weeks pregnant. She was again suffering from hyperemesis gravidarum, which, although necessitating admission to hospital, responded quickly to isolation, sedation and rest. The blood pressure was 128/80. At 16 weeks the blood pressure was found to be 200/130 and a trace of albumen was detected in the urine. The patient was re-admitted to hospital where she stayed for the remainder of the pregnancy. Renal function tests showed considerable impairment of function. The blood urea was 48 mg. per cent and the urea clearance 25 per cent of normal. An intravenous pyelogram showed delayed excretion of dye but the diurnal variation of urinary specific gravity was between 1,004 and 1,020. The optic fundi showed narrowing of the vessels and possibly early papilloedema.

Treatment with hexamethonium bromide was started. The dosage used, and the behaviour of the blood pressure are shown in Figure 1. The blood pressure readings showed marked irregular daily variations but the progressive increase in the dose of hexamethonium salt was needed to keep the blood pressure down to an average level of 180/110. Hexamethonium bitartrate was substituted for the bromide salt to overcome the depressant effects of the latter.

The uterus increased steadily in size, although it was always considered that the foetus was small in relation to the calculated period of gestation. The patient's general condition remained satisfactory, except that at the 20th week (11th September, 1952) a slightly cyanotic appearance was noted, which was however transient.

By the 35th week there was some tachypnoea and 4 days later the patient felt and looked unwell. She complained of lower thoracic pain on deep inspiration, and slight cyanosis was again apparent. There were signs in the chest suggesting right lower lobe consolidation. Clinical examination and an electrocardiographic tracing failed to show any evidence of left ventricular failure. The following day the patient's condition was worse; cyanosis and dyspnoea were marked, and slight ankle oedema appeared.

The administration of hexamethonium was discontinued. Oxygen was given intermittently, chemotherapy was instituted, and Digoxin 0·25 mg. 8-hourly, was given. Twenty-four hours later the patient's condition showed some improvement, but signs of consolidation were now detected at the left base. The patient's temperature was not raised at any stage of her illness.

In so far as a firm diagnosis could be made, it was considered that the condition present was some obscure pulmonary complication, possibly infarction, with intrapulmonary thrombosis. This conclusion is interesting in view of the later findings.

Labour commenced spontaneously after a further 24 hours, and was followed 9 hours later by the rapid and easy delivery of a living female infant weighing 2 pounds 10 ounces (1·19 Kg.). The placenta was delivered normally 5 minutes later with a loss of 4 ounces (114 ml.). Labour had been easy and undisturbing to the mother whose general condition was considered to be unaltered.

The baby was limp at birth, and only gasping respira-

tion was established. The infant survived for 80 minutes.

Following delivery the mother's blood pressure was 136/78. Her condition remained unchanged for 8 hours but subsequently deteriorated. She became comatose and cyanosed. Death occurred 14 hours after delivery.

An X-ray of the thorax was taken 3 days before death (Fig. 2). Owing to the severity of the illness only a "portable" film could be obtained. We are grateful to Dr. James H. Smitham, Kingston Hospital, for the following remarks on this film (24th May, 1955):

"The main things which are apparent are some enlargement of the left ventricle and unfolding of the aorta. There is also widespread patchy consolidation in the right lung which is central rather than peripheral in distribution and there is a small quantity of fluid at the right base. There is also, I think, a small quantity of fluid in the left base in the costo-phrenic angle. The appearances would do very well for pulmonary oedema, of the type seen in incipient left ventricular failure.

"So far as I can make out the appearances here are very similar to those described by Doniach *et al.* (1954)."

At the necropsy performed by Dr. J. C. Lees, Kingston Hospital, Kingston-on-Thames, the main findings were:

Heart. Enlargement of moderate degree due to left ventricular hypertrophy.

Kidneys. A moderate amount of shrinkage, with scarring: some appearances rather suggestive of early cortical necrosis. Microscopically there is evidence of chronic pyelonephritis and moderately advanced arteriolar nephrosclerosis. Cortical tubules show advanced necrosis but it is difficult to know how much this is due to post-mortem autolysis.

Respiratory System. Right pleural cavity contained 600 ml. of clear greenish fluid.

Right lung: apart from a small area at the apex and a narrow band along the costophrenic margin, the lung substance was of an abnormally firm consistency with a rather dry cut surface exuding little air or fluid on pressure. No pus was seen. Some areas of haemorrhage were present, up to 3 cm. in diameter and not always abutting on the pleural surface. No ante-mortem thrombus was found in the pulmonary arterial tree.

Left lung: the upper half of the upper lobe was of normal consistency. The rest of the upper lobe and the whole of the lower lobe showed appearances similar to those of the right lung.

Macroscopic appearances suggested that the relative solidity and dryness of the lungs was due to a rather gelatinous oedema and patchy fine fibrosis.

The lungs were incised and placed in fixative, and kindly sent by Dr. Lees to one of us (W.W.P.) in view of his interest in other changes in the lungs during pregnancy.

Histology of the Lungs

Two blocks of tissue, one peripheral and one more central, were taken from each of the upper and lower lobes. Since it was thought that the condition might be one of massive placental tissue infarction, the blocks were chosen at random: no attempt was made, for example, to choose those areas which appeared to be the most fibrous.

The histological findings in all the sections are qualitatively essentially the same; there is quantitative variation in that not all sections show the various types of tissue abnormality to the same extent. As may be seen in Figure 3, showing the whole of one of the sections, the general architecture of the lung is severely deranged. This is due to the co-existence of areas of haemorrhage, oedema in various stages of coagulation, organizing exudate, fibrosis, collapse and compensatory emphysema. Tissue density tends to be greater centrally than beneath the pleura, but, taking the sections as a whole, subpleural fibrosis was commonly seen. There is no tendency for any particular form of tissue abnormality to be located predominantly in any particular zone of the lung.

Haemorrhage. This is present over many relatively large areas. It is recent haemorrhage, filling alveoli and alveolar ducts. Alveolar walls in these areas retain their normal staining properties, and obliteration of architecture characteristic of old infarction has not occurred. Haemosiderosis is not seen in any area.

Oedema. Even in the few small areas where pulmonary architecture is otherwise normal, oedema is seen. One of the more oedematous areas is shown in Figure 4. The oedema has the familiar appearance of a thin, smooth coagulum broken up by bubbles of air. Such oedema is of recent, perhaps terminal, origin. Exudation of longer standing is signified by the formation of hyaline or "asphyxial" membranes lining alveoli and alveolar ducts (Fig. 5). The staining reactions of these membranes show that fibrin formation is occurring in some places. Intra-

alveolar exudate is also prominent, and also shows partial conversion into fibrin. A further stage in the process—or so we interpret it—is evident organization of the fibrinous exudate and the appearance therein of young fibrous tissue. This is shown in Figure 6. Alveolar walls can still be discerned, and many alveoli contain fibrous tissue; the dark areas mingled with the fibrous tissue indicate fibrin which has not yet been absorbed. Ultimately patches of diffuse fibrosis are produced (Fig. 7). The fibrous tissue is young and cellular: dense collagen formation has not occurred. The features of Figure 8 show that this fibrosis is not an interstitial fibrosis: the elastic tissue pattern of the alveolar walls is well maintained, and the walls themselves are not greatly thickened. It is true that apparent alveolar wall thickening is seen in many places, as for example, in the upper left area of Figure 4. Appropriate staining, however, shows that this kind of appearance is almost always produced by collapse of alveoli and coalescence of their walls. In other places alveolar walls are truly thickened, but by exuded fluid and macrophages. Genuine interstitial fibrosis is minimal. Cuboidal metaplasia of the alveolar "epithelium" is rarely seen. Many alveoli, however, are filled with relatively large cells which may represent a desquamated lining although some at least, from their particulate content, appear to be macrophages.

Discussion

The abnormalities in this patient's lungs were many. They included homogenous proteinous exudate: hyaline membrane converted in part to fibrinous coagulum: pure fibrinous coagulum: fibrinous coagulum converted in part to fibrous tissue: and fibrous tissue, patchy in distribution and cellular in character. All but the first of these findings denote fibrinous precipitation in, and organization of, a pulmonary exudate of high protein content. The final result, seen in many of the sections, is occupation of the alveoli and related fine air passages by a still cellular, not markedly collagenous, fibrous tissue. This is a patchy development, not a true carnification of the lung.

The patient's story of a vague illness, possibly pneumonia, 4 years before the final illness, raises the question whether the abnormalities now seen in the lung may not be sequelae of that illness. This seems improbable, for, of the changes seen, all but the areas of fibrosis are clearly of recent origin. These areas of fibrosis have a structure which is almost indistinguishable from that sometimes seen in unresolved pneumonia but, in our experience, only when the patient has died in the third or fourth week with evidence of infection still manifest. The intra-alveolar fibrous tissue shows little or no retraction from the alveolar walls, and the alveolar pattern is on the whole well preserved—features which further confirm the view that this fibrosis is not the sequel of a pneumonia 4 years earlier.

The interpretations of the histological appearances must take note of the co-existence in the sections of apparently recent exudation and of varying degrees of resolution and organization. These might be interpreted as the result of a single massive exudation with variation from place to place in the efficiency of the processes of resolution and organization. Such an idea is certainly quite contrary to the generally accepted view, and to our own experience; and further, a single outpouring of fluid of this degree would surely have proved immediately lethal. It seems reasonable, therefore, to interpret the appearances, including the fibrin formation and fibrosis, as reactions of the lung to repeated sublethal episodes of fluid exudation of high protein content.

The mechanism causing such episodes of highly proteinous pulmonary oedema, with formation of fibrin and fibrous tissue in the alveoli, in the non-infected lung is uncertain. Widespread fibrin casts were seen by Lendrum, Scott and Park (1950) in the alveolar ducts and alveoli of patients with clinically manifest heart failure due to rheumatic and to hypertensive disease. It would seem clear, therefore, that, without defining the term more closely, "cardiac failure" is at least a contributory factor in the production of this kind of pulmonary oedema. Intermittent heart failure, but of the left side of the heart, was thought by Doniach *et al.* to be the cause of the oedema in their hexamethonium treated cases, but doubt has been expressed by Altschule (1954) whether failure of the left ventricle alone ever occurs: there is

certainly no convincing evidence from experimental procedures that it ever does. However, so long as the question remains undecided, it seems reasonable to argue that, since the myocardium of the left ventricle may undergo a pure or isolated hypertrophy, it may also undergo a pure or isolated failure. It does not follow, however, that isolated failure of the left ventricle is in fact the upset that precedes pulmonary oedema, at least of the type and degree under discussion. Cameron (1948) considers that ". . . no more than a transitory dissociation of output from the ventricles is conceivable, for just as soon as the pulmonary vessels become engorged automatic regulation of cardiac function occurs with compensation of back pressure". Similar views are expressed by Altschule. It may be wise, therefore, to go no farther meantime than say that certain acute cardiac dysfunctions may be associated with intrapulmonary exudation, and that the exudate may on occasion contain fibrinogen.

The formation of fibrin in non-infected exudates within the lung has attracted increasing attention within recent years. As well as appearing in the cases of cardiac failure just mentioned, and in the hexamethonium-treated cases of Doniach *et al.*, it has been described in cases of uraemia by Doniach (1947, with earlier references) and by Hopps and Wissler (1955), the last-named workers finding it in 62 per cent of a series of 107 uraemic patients, and in occasional examples of the Hamman-Rich syndrome (Pokorny and Hellwig, 1955).

It is probable that all cases of uraemia, apart from the acute recoverable forms, are complicated to some extent by cardiac failure. Therefore, even when clinically inconspicuous, cardiac failure may partly explain the formation of a pulmonary exudate, and thus of intra-alveolar fibrin, in uraemic cases. Fibrin within the alveoli is, however, too frequent a finding in cases of uraemia to be satisfactorily explained on this basis alone—especially when the degree of failure may be minimal. Therefore, some further factor, associated maybe with the abnormal biochemistry of the blood, is probably present, a factor that increases capillary permeability: fibrin casts thus occur in association with a degree of cardiac failure that is less than the degree of failure that causes these casts when the pulmonary capillaries are healthy. This may also be in part the reason why non-infected fibrin casts are seen relatively more frequently in uraemic cases than in any other type of case: only patients with lesser degrees of cardiac failure survive long enough for fibrin to form and be present in sufficient quantity to be discovered in the few random blocks taken at routine necropsy. However, if this explanation be true, it is difficult to understand why diffuse fibrosis is so rare in uraemic lungs.

The later history of patients showing intrapulmonary fibrin casts is rarely known—because of the seriousness of the causal condition. However, it seems probable that, in the hexamethonium-treated cases at least, therapy allows a sufficient prolongation of life for a later stage of development to be seen than would otherwise be possible. Whatever be the explanation, the end-result is an appearance quite unlike that in the Hamman-Rich syndrome with its interstitial fibrosis and thickening of alveolar walls. There is no interstitial fibrosis in our case, and we find it hard to believe either that the lungs did pass through an initial stage of interstitial fibrosis or that they could progress to such a state with the passage of time, despite the views of Peabody and Peabody (1954) that the histology of hexamethonium lungs resembles that of the Hamman-Rich syndrome.

The fibrin casts in uraemic lungs may show some evidence of organization but this is nearly always small in amount and inconspicuous: diffuse fibrosis is rarely, if ever, seen. This may indicate either that organization is at an early stage or that it is inefficient and slow to start. Since many patients may live in a state of uraemia for some weeks or months, we suspect that inefficient organization is the true explanation. The discrepancy between the extensive organization and fibrosis in hexamethonium lungs and its paucity in uraemic lungs is puzzling and, so far as we know, unexplained.

Fibrin in any situation is ultimately removed by lysis. In infected exudates this is achieved, perhaps exclusively so, by leucocytic enzymes. In non-infected exudates it seems necessary to ascribe the disappearance of fibrin to soluble fibrinolysins present in plasma or tissue fluid.

FIG. 2
A film of the chest taken 3 days before death. (See text.)

FIG. 3

The texture of the lung is very uneven. Areas of increased density due to organizing oedema and fibrosis contrast prominently with areas of compensatory emphysema. Picro-Mallory. ×4.

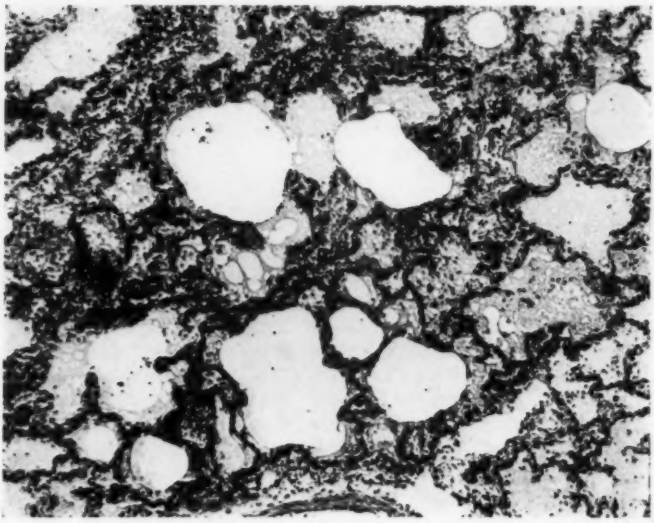

FIG. 4

An area of oedema, probably agonal: neither fibrin nor organization can be seen. The alveolar walls show no undue thickening. Areas of apparent alveolar wall thickening in the upper part of the field are produced by collapse and coalescence of alveoli. Haematoxylin and eosin. ×64.

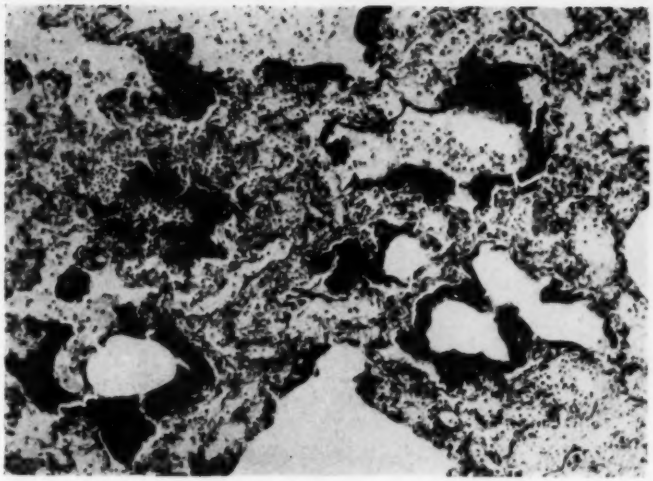

FIG. 5

Membrane formation in alveolar ducts and alveoli. The membranes, frequently of great thickness, are mainly serous coagula. They stain a deep blue with the picro-Mallory stain but, at high magnification, show occasional strands of red-staining fibrinous material in the deeper layers. Picro-Mallory. Minus blue filter. ×98.

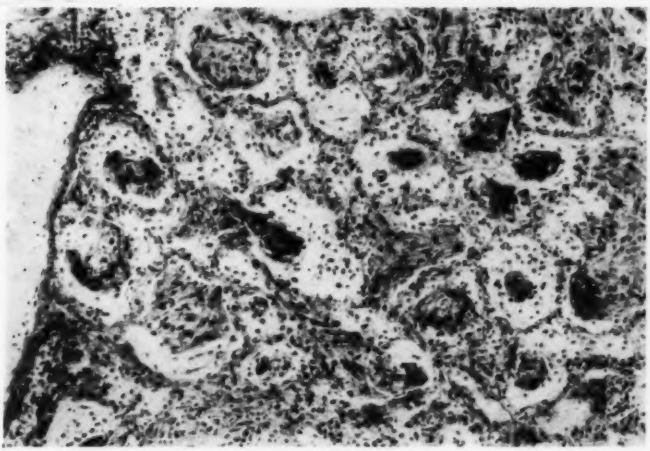

FIG. 6

A field from a zone of organization. The alveolar pattern is still recognizable. Many of the alveoli contain a mixture of fibrin (black) and cellular fibrous tissue. Picro-Mallory. Minus red filter. ×100.

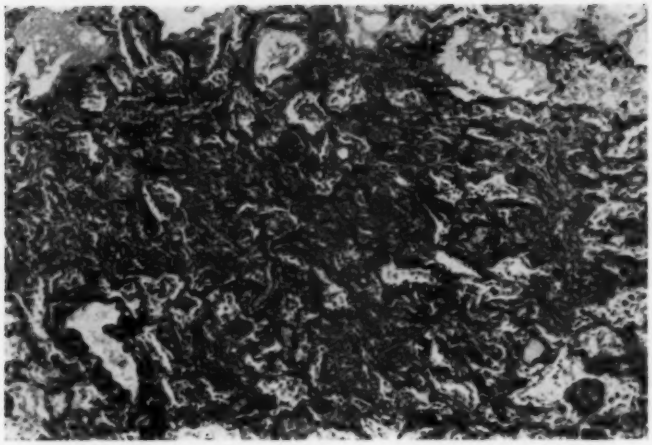

FIG. 7

An area of diffuse fine fibrosis. The fibrous tissue is cellular: dense collagen formation has not yet taken place. van Gieson. ×60.

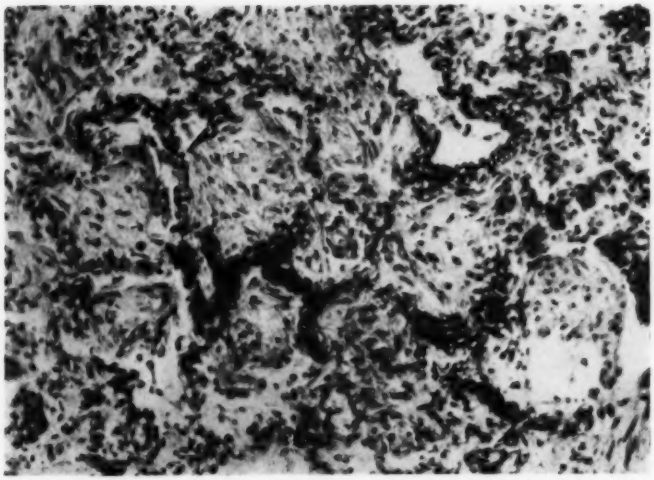

FIG. 8

Elastic tissue staining shows that alveolar architecture has been relatively well maintained despite the diffuse fibrosis. Also, there is no evidence of a significant degree of interstitial fibrosis. Weigert's elastica, haemalum and light green. ×161.

Of the factors controlling fibrinolysis in the absence of leucocytes little is known. It is almost certainly a highly complex process, probably as complex as that of fibrin-formation itself, and it would not be surprising if at times it became deranged. If fibrinolysis in the lung is inadequate or fails altogether, subsequent fibrosis appears to be inevitable, though once again it has to be admitted that knowledge of the physico-chemical processes determining the occurrence or non-occurrence of fibrosis is still very limited. Of the factors which might conceivably influence the onset and speed of fibrinolysis the age of the fibrin, that is, the length of time it has lain in the alveoli, cannot be admitted as relevant, since the age of the fibrin is itself a function of fibrinolysis. There may, however, be different types of fibrin. Whether the fibrin of the pathologist, produced as it is by widely different diseases, always has exactly the same constitution and properties in all circumstances may be doubted. It would be surprising if it were always identical with the pure fibrin of the haematologist, prepared from purified fibrinogen and thrombin. The fact that two forms of purified fibrin clot, one soluble and the other insoluble in urea, have been shown to exist (Lorand, 1950) goes some way to support these speculations, as does the observation of Sandritter and Bergerhof (1954) that four morphologically distinct types of fibrin can be identified in necropsy tissues. Differences in the constitution of fibrin, which might perhaps be better written "fibrin", may well be the explanation of such unusual features as the curious resistance to lysis and organization shown by the fibrin in uraemic pulmonary exudates, and the relative rapidity and extent of organization in "hexamethonium lung".

The possibility that some direct toxic action of hexamethonium compounds is responsible for the pulmonary changes was mentioned by Morrow and by Doniach and their colleagues. Doniach *et al.* consider this unlikely, and recall that animal experiments carried out by other workers had provided no evidence to incriminate hexamethonium as such. However, the remarkable and specific action of alpha-naphthyl thiourea (ANTU), reminds us that the normal permeability of pulmonary capillaries can be dramatically increased by direct drug action (Richter, 1945). It is still too early, we feel, to absolve hexamethonium entirely from blame in this respect, rare though pulmonary complications in hexamethonium therapy may be. We have further considered whether the small size of the infant in our case, the prematurity of its birth and its short survival might also be in some way attributable to toxic drug action. This possibility cannot be excluded beyond doubt but we feel that the severity of the mother's illness is by itself an adequate explanation for these features of the case. Like Morris (1953), in his account of the use of hexamethonium in 10 cases of hypertension during pregnancy, we do not think that the drug had any influence on the course of labour.

The hexamethonium lung poses two questions —how does the highly proteinous oedema arise, and why is organization and fibrosis so prominent? We have briefly discussed both matters. It seems reasonable to associate the attacks of pulmonary oedema with episodes of cardiac failure which, because of the nature of the disease, is likely to be a hypertensive and therefore a left ventricular failure. The precise way in which a failing left ventricle favours the development of pulmonary oedema is not, so far as we can assess the evidence, fully understood. Some factor, such as anoxia, which directly impairs capillary permeability, is probably required in addition to dissociation of output between the ventricles: opinions vary as to the existence and degree of such a dissociation of output. It is, we feel, too early to exclude the possibility that hexamethonium itself may have a damaging effect on pulmonary capillaries. The intra-alveolar fibrosis, never prominent in untreated hypertensive cases, may occur because these patients survive repeated episodes of near-lethal pulmonary oedema, and with each there is a consequent organization. Other factors may, however, be involved, such as differences in the type of fibrin, differences in the rate and efficiency of fibrinolysis, and in the speed of onset of organization.

Summary

The case is reported of a woman of 37, treated with hexamethonium compounds for

severe hypertension during her 8th pregnancy. She died after the birth of a live infant, in the 36th week. Treatment with hexamethonium drugs had been continuous, in increasing dosage, from the 17th week. Severe, ultimately fatal, respiratory disease developed during the 35th week. Necropsy showed nephrosclerosis, hypertrophy of the left ventricle, and a state of "solid oedema" and widespread fine fibrosis throughout both lungs. Microscopically the condition was one of non-infected, fibrinous, pulmonary oedema with organization and areas of fibrosis. The possible mechanism of development of the lesion is discussed.

We wish to thank Mr. J. V. O'Sullivan for permission to publish this case, and our thanks are also due to him and to Professor A. C. Lendrum for many helpful comments during the preparation of this report. We are indebted to Dr. J. C. Lees for the necropsy findings, to Dr. J. H. Smitham for the X-ray report, and to Mr. J. W. Corkhill for assistance with the photomicrography.

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A COMPARISON OF A BATHING AND A NON-BATHING TECHNIQUE FOR THE ROUTINE CARE OF THE SKIN OF THE NEWBORN

BY

LAETITIA BRUCE, M.B., Ch.B.

Late Paediatric Registrar

Princess Mary Maternity Hospital, Newcastle-upon-Tyne

THE care of the skin of the newborn has been the subject of several articles during recent years (Guy and Jacob, 1934; Sanford, 1937; Smith, 1938; Durand *et al.*, 1938). None have compared the traditional method, which includes bathing the baby regularly with soap and water from the start, with a non-bathing technique used simultaneously in a comparable group of babies. Sandford (1937) who has studied the problem with great care, obtained excellent results, with a very low incidence of infection, during a period when the babies in his hospital had no routine attention to their skins at all, apart from the wiping off of any excess blood present on the skin at birth. The same technique was also repeated by Smith (1938) and by Durand and others (1938).

In a maternity hospital any simplification of nursing procedures with reduction in the handling of babies by nurses has such obvious advantages that it was decided to study the effects of a modified non-bathing technique in a selected group of babies in the Princess Mary Maternity Hospital. A comparable group of babies, bathed in the traditional way, was to act as controls, and the results were to be assessed by recording and comparing the incidence of all forms of acquired lesions of the skin in the two groups of babies.

The hospital contains 60 lying-in beds, in four units, and there are some 2,000 births each year. It is the practice for all normal, mature babies to be taken straight from the delivery-room to the same lying-in unit as their mother: and after the initial toilet each baby is taken in his cot to his mother's bedside, where he stays until he goes home. As much as possible of his nursing care is carried out by his mother. Most premature babies, and many of those who have had abnormal deliveries, go instead to a special nursing unit and, although many of these babies are later transferred to the lying-in units to be with their mothers, none was included in this investigation. Also, one of the lying-in units is reserved for infected or potentially infected mothers, and babies who were transferred to this unit with their mothers were taken out of the investigation.

Of the three lying-in units for uninfected mothers, two are almost identical in structure, but situated on different floors. The investigation was confined to these two units (A and B), and all babies admitted directly to them from the delivery-rooms during the course of the investigation were included. Each unit had 18 beds: 8 in a large single room, and 10 in a series of small rooms each containing 2 or 4 beds. Because of the known tendency for infection rates in different units to differ, both techniques of care were used in both units: babies in the large room of unit A and the small rooms of unit B were bathed, and those in the large room of unit B and the small rooms of unit A were not bathed. The technique of skin care used for any particular baby therefore depended entirely upon the room to which his mother was admitted.

Each unit also had a "baby room" equipped with two porcelain built-in baby-baths. Babies spent the first few hours of life in these rooms, in their own cots; and an occasional baby who was very noisy at night might be taken there from his mother's room for a few hours, in his cot. Otherwise this room was used only for

storing linen, linen trolleys and weighing machine trolleys: and for the baby's initial toilet, and his subsequent bathing in accordance with the plan of the investigation.

The investigation was started in September, 1952, and brought to an end after 4 months, when 289 babies had been included, and enough had been learnt to guide the hospital in its future policy.

Nursing Techniques

(Common in the two groups)

Eyes. The lids were swabbed with dry sterile wool at delivery and at the time of the first toilet, to remove any visible excess of vernix. No other treatment was given except on medical instruction.

Face. This was washed with cotton-wool pledgets soaked in tap water at the first toilet, and at the daily toilet.

Nose. Nothing was done unless there was some visible discharge which was removed with pledgets of cotton-wool soaked in tap water.

Cord. At the time of delivery the cord was clamped and cut some 3 or 4 inches from the abdominal wall. At the first toilet it was tied off with strong thread almost half an inch from the skin margin, and the distal portion was cut off with scissors, close to the ligature. No dressing was applied, but the base of the stump was swabbed with ether-soaked cotton wool held in forceps at the daily toilet.

Cream and powders. None were used routinely in either group of babies. But if a particular baby's buttocks or flexures seemed sore, ½ per cent cetrimide cream was applied.

Changing of napkins. This was carried out in the cot, by the mother or a nurse, using a trolley for the supply of clean napkins and the disposal of dirty ones. If the buttocks were soiled with meconium or faeces this was removed with cotton-wool swabs and a 1 per cent solution of cetrimide during the early weeks of investigation. But it was found that this solution was liable to cause soreness of the flexures unless it was carefully wiped off again after cleansing had been achieved. This difficulty was overcome later in the investigation by using a more dilute solution of cetrimide, at a concentration of 1 in 500, and the flexures were dried with cotton wool after being washed in this way.

Clothes. Each baby wore a stockinette vest and a short cotton gown, and was wrapped in a flannelette sheet to protect him from contact with blankets. It was possible to carry out a complete change of clothes daily.

Nursing Procedures

(Differing in the two groups)

The main differences were in the methods used for cleansing the baby's trunk and limbs at the first toilet (usually some 6–12 hours after delivery), and daily thereafter. These were as follows:

When bathing. At the first toilet in the "baby room" the nurse soaped his trunk and limbs as he lay on her knees. She then immersed him in warm water in one of the baby-baths, to wash off the soap, taking care to keep his umbilicus out of the water. She then dried him on his individual towel, on her knee, before dressing him and returning him to his cot. This procedure was repeated once daily, in the baby-room.

When not bathing. The first toilet was carried out in the "baby-room", the nurse keeping the baby on her knee throughout. She left his trunk and limbs untouched unless there were unsightly quantities of blood, meconium or vernix visible on his skin, in which case she wiped them off with pledgets of wool moistened with the cetrimide solution (for its strength, see under "changing of napkins", above). Large amounts of vernix, requiring to be wiped off in accordance with the instructions given for the investigation, were present in the flexures of the neck, axillae or groins in a majority of the babies. The nurse dried off the cetrimide solution with wool pledgets before dressing him and returning him to his cot. The baby then normally stayed in his cot at his mother's bedside until the day of discharge from hospital. The daily toilet of face and umbilicus, and complete change of clothes, were carried out in his cot. On the day of discharge, however, he was taken to the "baby-room" to be bathed with soap and water in the usual way, before being changed into his own clothes ready to go home.

Observation and Recording

The whole skin of each infant was examined on alternate days by a paediatrician as a routine procedure. In addition, individual babies were examined at other times, whenever an abnormality was reported by the nursing staff, who maintained the high standard of observation which had long been established in the hospital. All abnormalities were recorded, under one of the following four headings:

(1) *Irritation rash.* At least 3 different types of lesion were included under this heading, since they could not always be distinguished from each other with certainty, and their very frequent simultaneous occurrence on different parts of the same baby suggested a common causation.

(*a*) Simple erythematous patches with ill-defined edges, varying in size from 2 or 3 mm. up to a centimetre or so in diameter.

(*b*) Similar lesions which were infiltrated (and therefore palpable) or actually raised, often with a minute pin-point vesicle in the centre. These lesions were confluent in the more severe cases.

(*c*) Frankly urticarial lesions, with a central pale weal. This was the least common of the three.

(2) *Pustule.* Any raised red lesion with a central vesicle which contained definitely yellow material was called a pustule.

Commonly the red area was 1 or 2 mm. in diameter, and the central yellow vesicle measured up to 2 or 3 mm. in diameter and there was only a barely detectable rim of reddening round it.

(3) *Paronychia.* This heading is self-explanatory in those very few cases where there was frank pus-formation, resulting in a small abscess alongside the nail. It was also used to cover all cases in which there was very obvious reddening of the skin at the side of the nail, with a small superficial ulceration (usually made more apparent by the presence of a small scab during the stage of healing). Cases in which there was some reddening only, without ulceration or pus formation, were not included since they shaded imperceptibly into the normal.

(4) *Sore Flexures.* This heading included all cases in which the skin was definitely reddened in one or more flexures. The groins, axillae and neck were the areas affected, in that order of frequency.

The Skin Lesions Recorded in Two Groups of Babies Cared for by Two Different Nursing Techniques

	Without Bathing		With Bathing	
		Per cent		Per cent
Babies at risk ..	160		129	
Irritation rashes ..	28	17	19	14
Pustules	21	13	21	16
Paronychiae ..	13	8	7	5
Sore flexures ..	31	19	15	12

In an occasional, very severe, case there was actual loss of skin surface, with purulent exudation.

Within each of these headings two grades of severity were defined, and all abnormalities were recorded as "mild" or "severe". But examination of the results at the end showed that the two degrees of severity occurred in the same proportions in the two groups of babies (and the number of "severe" cases under each heading was in any case very small): so only the absolute incidence of the various abnormalities is reported here, in the interest of simplicity.

Results. These are summarized in the Table. The fact that there were more babies in the "non-bathing" group is due to the chance that part of Unit A was closed to routine admissions for a period during the investigation for the final qualifying examination in Medicine. The average duration of stay in the hospital was approximately the same for both groups of babies. Therefore, comparison between the percentage incidence of the various abnormalities in the two groups seems a reasonable way of assessing the results. The only statistically significant difference is in the higher incidence of sore flexures in the group who were not bathed; but this is largely accounted for by the use of 1 per cent cetrimide, without adequate drying afterwards, during the first weeks of the investigation. Later, when particular care was taken over the drying, and a 1 in 500 solution was used, the incidence of sore flexures was approximately the same in the two groups.

Comment

Since there was no significant difference observed between the results of the two different

methods of skin care which had been investigated, it was necessary to fall back upon other considerations when deciding which method to recommend for routine use in the hospital in future. From the aesthetic viewpoint, there was some difference of opinion between different members of the nursing and medical staff about the babies in the group who were not bathed. There were those who missed the smell of baby-soap, and even detected some less pleasant odour in its place. Others felt that you could not tell the difference after a few hours, and were more inclined to marvel at the surprising cleanness and freshness of the babies, as was Smith (1938). The decision of the staff was, therefore, finally based on what appeared to be inherent advantages in the "non-bathing" technique. Nursing procedures were simplified, and nursing-time saved; babies were less frequently handled by nurses: use of communal baby-baths was almost eliminated. All this tended to reduce the risks of cross-infection. Psychologically, too, it seemed good that the mother should have her baby continually beside her until she took him home. These advantages apply almost entirely to hospital confinements; they could be of little, if any, importance in the home.

The non-bathing technique was therefore adopted for routine use throughout the hospital early in 1953, and has proved perfectly satisfactory. Indeed the question now is whether we should not go further along the same road and adopt the truly "dry" technique of Sanford.

Summary

(1) The skins of 160 normal babies were not bathed during their stay in hospital; blood, meconium or excess of vernix, present on the skin at birth, was removed with the help of a dilute solution of cetrimide at the initial toilet. Subsequently the same solution was used for cleansing the buttocks of meconium or faeces when indicated. As controls there were 129 comparable babies, but bathed with soap and water daily.

(2) There was no difference in the recorded incidence of irritation rashes, pustules and paronychiae in the two groups of babies. There was a higher incidence of sore flexures in the "non-bathing" group at the start: but this was attributed to the use of a 1 in 100 solution of cetrimide and disappeared when a 1 in 500 solution was adopted for routine use.

(3) In view of its many advantages the non-bathing technique was accordingly adopted for routine use throughout the hospital. It has proved very satisfactory over the following 3 years.

This work is part of a continuing study of methods in the routine care of the newborn in the teaching Maternity Hospital of the University of Durham. I should like to thank Dr. G. A. Neligan for his valuable assistance, Professor Harvey Evers and Professor Donald Court for their interest and encouragement, and Miss Elcoat and Miss Kent and their nurses whose meticulous observation of the infants in the wards contributed so greatly to the enquiry and the later application of the lessons learnt.

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BACTERAEMIA AS A CAUSE OF OBSTETRIC SHOCK

BY

J. G. DUMOULIN, *M.B.E.*, M.D., M.R.C.O.G.

AND

G. R. STEED, M.D., M.R.C.P.

South Devon and East Cornwall Hospital, Plymouth

OBSTETRIC shock as a complication of labour is fully discussed in most textbooks of midwifery. Sheehan (1948) recorded 147 cases who died of shock and reviewed the recognized causes. Infection, however, has not been mentioned by him or other authors who have discussed the aetiology. Obstetricians familiar with conditions in primitive parts of the world are aware of the profound shock which is associated with severe infection acquired during childbirth. That a similar state may be seen in this country is illustrated by the following 2 cases.

Case 1

Mrs. R., age 30, was admitted to hospital on 20th November, 1951 because she was 20 days overdue in her first pregnancy. She had had trichomonas vaginitis treated during pregnancy. At 11.15 a.m. surgical induction was performed by rupture of the forewaters. The following morning labour had not started, and she complained of feeling cold. Her temperature was 100·5°. At the onset of labour 26 hours after induction the patient's temperature was 103° and pulse rate 120 per minute. Examination revealed no obvious cause for the pyrexia. Vaginal swab, urine examination and blood culture were taken. Sulphadimidine and, 3 hours later, penicillin therapy was started.

Labour lasted 4 hours. At the start of the second stage there was severe foetal distress. An easy low forceps delivery was performed under general anaesthesia, but the baby, weighing 5 pounds 5 ounces was stillborn. Thick purulent offensive meconium-stained liquor was aspirated from the baby's mouth. Placenta and membranes were delivered 15 minutes later, and the episiotomy repaired. The total blood loss was 4 ounces (113 ml.).

One and a half hours after delivery the patient was gaining consciousness. She was flushed and perspiring, temperature 101·8°, pulse 160 and respirations 20 per minute. Her blood pressure could not be recorded. There was no vaginal bleeding and the uterus was well contracted. Vaginal examination showed no evidence of uterine rupture.

She was put in an oxygen tent, and Methedrine was given. Penicillin and streptomycin were also injected. She remained in a condition of profound shock for 3 hours during which time no blood pressure reading could be obtained. After that, she gradually improved, and ultimately made a satisfactory recovery. She has since had 2 normal deliveries.

The results of the bacteriological examination showed that the urine was sterile. The vaginal swab showed numerous pus cells and, on culture, a heavy growth of *Bacterium coli*. Similarly, there was a heavy growth of *Bact. coli* in the blood culture.

This case illustrates that severe shock can result from bacteraemia acquired in labour. The uterine cavity would appear to have been infected during surgical induction.

Case 2

Mrs. C., age 24, had a normal delivery of a second baby at home on 12th January, 1955 at 11.10 a.m. Following this she had a post-partum blood loss of 20–30 ounces with continued uterine filling of blood in spite of the use of oxytocic drugs. The "flying squad" was therefore summoned and arrived at 1.30 p.m. The patient was conscious, pale and rational. Her blood pressure was 90/70. A blood transfusion of 2 pints (1,136 ml.) of Group O blood was given. During the second bottle, as the last few ounces were going in, the patient vomited. At 3 p.m. her blood pressure was 130/70. The uterus was contracted. Her general condition was, however, not satisfactory. She was confused, restless and flushed, and vomiting continued. A steady trickle of blood issued from the vagina.

She was transferred to hospital arriving at 5.15 p.m. by which time she was comatose. Her face was a bright scarlet, the colour extending down the neck with a patchy erythema of the rest of the body. Her temperature was 101°. Her pulse and blood pressure could not be obtained. The uterus was flaccid. Three hundred ml. of liquid blood were expelled from the vagina. One hundred ml. of urine were obtained. Blood was taken for a blood count and culture.

On admission, ergometrine was given and intravenous Dextraven (250 ml.) followed by 740 ml. of cross-matched blood to which were added 3 ml. of noradrenaline (Levophed). Penicillin, streptomycin and cortisone

(100 mg.) treatment was also started. Blood which was withdrawn from a vein failed to clot, and wherever the patient was pricked a haematoma formed. Fibrinogen was therefore given. Intravenous therapy was continued with 5 per cent glucose solution as a medium for the noradrenaline.

As a result of the emergency treatment the patient's blood pressure became recordable (50/30–90/60). The pulse, when detectable, varied between 108 and 136. Throughout the first 24 hours the patient remained comatose and flushed. A trickle of blood continued from the vagina.

Over the succeeding 48 hours her blood pressure was maintained at about 60 mm. systolic by continued intravenous noradrenaline. There was oliguria, the urine containing red blood cells and albumen. Towards the end of the second day after admission there was a slight but gradual improvement in the patient's general level of consciousness. The erythema gave way to a rapidly deepening jaundice and widespread petechial haemorrhages occurred all over the body. Vitamin K was given. There was further improvement the next day with a good urinary output (2,130 ml.). On recovering consciousness she complained of deafness. Streptomycin was therefore stopped and Terramycin 250 mg. 6-hourly substituted. On the fourth day after admission the intravenous noradrenaline therapy was stopped as the blood pressure remained steady at 110/70. Thereafter, there was a marked diuresis. Jaundice and petechiae persisted for 2 weeks. The patient was discharged from hospital on 5th February, fully recovered.

Unfortunately when the blood transfusion was dismantled at the patient's home before admission to hospital, the bottles and tubing were washed out. Bacteriological study of the bottles revealed no evidence of infection. The characteristic onset of a profound condition of shock associated with an equally profound toxic erythema developing during blood transfusion, suggested the diagnosis of transfusion of infected blood. Bacteraemia was confirmed by a heavy growth of *Bact. coli* from the blood culture, reactions of which are reported in the Addendum to this paper.

Discussion

Transfusion reactions from contamination of stored blood are fortunately rare. They were reported during the second world war (Strumia and McGraw, 1941; Officer, 1942; Whitby, 1942). Stevens *et al.* (1953) reviewed 41 cases from the literature and their own experience. They describe the condition noted in Case 2 of severe hypotension with contrasting intense erythema and warm extremities as a characteristic syndrome which they labelled "red shock". In their series the mortality was 60 per cent. Pittman (1953) adds a further 16 cases, 9 of which were fatal. A review of 35 cases of shock associated with bacteraemia is reported by Hall and Gold (1955) from a series of 100 patients with bacteraemia. The most frequent sources of the bacteraemia were the genito-urinary tract, peritonitis, cutaneous suppuration, the biliary tract, and lobar pneumonia. Where the condition of the skin was noted, less than half the patients had a warm flushed skin. The shock was thought to be due to bacterial endotoxins. Reports in the English literature seem to be confined to medico-legal cases (*British Medical Journal*, 1952; *Lancet*, 1953), although recently Lane (1955) described a maternal death from *Bact. coli* septicaemia associated with post-partum haemorrhage.

Braude *et al.* (1953) successfully treated a case with antibiotics, cortisone and noradrenaline. Hausmann and Lunt (1955) point out that severe shock and extensive tissue reaction with a warm skin suggest acute adrenal insufficiency. Intravenous transfusion of noradrenaline in large amounts may be life-saving in such cases. Wise, Shaffer and Spink (1952) have given as much as 136 mg. daily. But the most important treatment is the use of effective antibiotics.

Another feature of interest in Case 2 was the fact that blood withdrawn from a vein failed to clot. Afibrinogenaemia which is a recognized complication of certain conditions associated with pregnancy has been described in severe infection (McKay *et al.*, 1953; Jackson, Hartmann and Busby, 1955).

Summary

Two cases are presented of profound shock associated with labour in which a common factor was *Bact. coli* bacteraemia. In the first case the infection was acquired during surgical induction of labour, and in the second as the result of an infected blood transfusion.

It is suggested that in view of the satisfactory response to vigorous treatment this rare, but dangerous, condition should be borne in mind in cases of unexplained shock.

ADDENDUM

By C. H. JELLARD, B.M., B.Ch., Dip.Bact., Director, Public Health Laboratory, Plymouth

The coliform bacillus, reference no. 742/55, was isolated from a blood culture taken after transfusion of Case 2. The organism is an irregular type of *Bact. coli*, with some atypical features.

Sera from the patient taken on the sixth and fourteenth day of illness were tested for agglutinating antibodies with alcoholized ("O") and formalin treated ("H") suspensions of organism 742/55. Rising "O" and "H" antibody titres were demonstrated (see Table).

TABLE I

Antigen	Antibody Titres	
	6th Day of Illness	14th Day of Illness
"O"	1 in 800	1 in 3,200
"H"	1 in 400	1 in 6,000

A guinea pig, subcutaneously inoculated with 500 million organisms died after 36 hours. At post-mortem there was intensive haemorrhagic oedema of the tissues at the site of inoculation and a diffuse generalized red haemorrhagic congestion of the subcutaneous tissues.

More recently the following additional case has come to our notice. We are indebted to Mr. R. G. Maliphant for permission to publish the details.

Mrs. D.N., a primigravida, aged 32, was admitted to hospital as an emergency in labour on 21st November, 1954. She was transferred from another hospital because she had collapsed in labour. She had been given an oil-bath-enema induction of labour on 16th November, being two weeks overdue. Labour commenced at 2 a.m. on 17th November. The following night at 10 p.m. the membranes ruptured. The liquor was meconium stained. Contractions continued, ranging in intensity and frequency for the next 2 days. During this time the patient's pulse was rapid and she had a pyrexia varying between 99·4 and 102·6. At 3.20 a.m. on 21st November she had a rigor and collapsed. An intravenous transfusion was set up: 2 pints of dextrose saline, 2 pints of Dextran and ½ pint of blood were given. After the transfusion she developed pulmonary oedema and cyanosis.

At the time of transfer to Mr. Maliphant's care she had been in labour for 108 hours. She was dyspnoeic and cyanosed. Her pulse rate was 130, temperature 97° and blood pressure 60/35. The uterus was tense but not tender. There was a contraction ring palpable. The abdomen was distended. There was no urine in the bladder and none had been passed for 12 hours. Vaginal examination revealed a thick rim of cervix all round the vertex. There was no disproportion. Much thick blood-stained meconium escaped during the examination.

A diagnosis of uterine dysfunction, intra-partum infection and suprarenal insufficiency was made. Treatment included Terramycin, Eucortone, and oxygen. The following day there was little change. Penicillin therapy was given in addition and the Bull Borst regime was instituted. At 6 p.m. a general anaesthetic was given. The foetal head was perforated, a cephelotribe was applied and the crushed head was delivered after amyl nitrite had been given. Following cleidotomy, the foetal body was extracted through the constriction ring. The perineum was repaired. As there was a trickle of blood from the uterus the vagina was packed. The patient's blood pressure could not be recorded. Methedrine was administered and a blood transfusion was started. On catheterization, 1½ ounces of bloodstained urine was obtained.

Post-mortem of the infant showed gas bubbles in the abdominal wall and lungs. There was an offensive exudate in the peritoneal cavity. The patient was therefore given anti-gas gangrene serum.

On 23rd November the patient was very ill and irrational. A Levophed drip transfusion was instituted in view of the peripheral circulatory failure. Paraldehyde was used for sedation. The response to the noradrenaline drip was not marked although the urinary output was good (26 ounces). In the early hours of 24th November the patient was thought to be dying but she rallied and gradually improved. She developed hiccoughs and had faecal incontinence. Over the succeeding days the improvement was maintained. She was discharged home fit on 18th December.

The report on the Blood Culture which was taken at the first hospital was received on 25th November—*Bact. coli* grown.

COMMENT

The positive blood culture and clinical details leave no doubt in the opinion of the authors that this case represents a further example of obstetric shock due to *Bact. coli* bacteraemia. In this case the avenue of infection was apparently uterine, although it is obscure how such uterine infection arose.

ACKNOWLEDGMENT

We are grateful to Mr. N. L. White for permission to publish the first case.

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PLACENTA CIRCUMVALLATA

Its Aetiology and Clinical Significance

BY

JOHN H. M. PINKERTON, M.D., M.R.C.O.G.

From the Department of Obstetrics and Gynaecology, University College of the West Indies

ONE of the commonest and most striking aberrations of gross placental structure is the peripheral ring formed by a whitish circumferential area which is free of superficial blood vessels and which may or may not completely encircle the placenta. It was found in 25 per cent of the placentas of 2,019 consecutive deliveries, including 154 abortions, in the University College Hospital of the West Indies.

There are two types; *placenta marginata*, in which the ring is only slightly, if at all, raised above the rest of the placental surface and is not undermined and *placenta circumvallata* in which the ring is definitely raised and is undermined to a greater or lesser extent so that a recess is formed under it (Fig. 1). Placenta marginata is much commoner, occurring in 22·5 per cent of all the cases, while placenta circumvallata accounts for only 2·5 per cent. Either type of ring may be complete or incomplete, that is to say, the ring may or may not completely encircle the periphery of the placenta. In our material, one-fifth of the marginate placentas were complete, while four-fifths were incomplete; of the circumvallate placentas one-third were complete and two-thirds incomplete.

INCIDENCE OF THE CIRCUMVALLATE FORM

This communication is concerned largely with the circumvallate placentas of which 50 occurred in the series—an incidence of 2·5 per cent. The earlier writers, cited by Williams (1927), give a very high incidence of from 7·6 to 21·3 per cent. Williams himself, however, discovered the condition in only 2 per cent of his cases, while Hobbs and Price (1940) and Hunt, Mussey and Faber (1947) found 0·7 per cent and 0·5 per cent respectively. The high incidence given by earlier European workers was probably due to the inclusion of many cases of placenta marginata. On the other hand, an apparently low incidence of the condition will occur if only the more marked types are recorded. This may explain the discrepancy between the incidence given by Hobbs and Hunt and their co-workers, and that found in the present series (Table I).

TABLE I

Incidence and Clinical Significance of Placenta Circumvallata as Recorded by Various Workers

(Percentages in brackets)

	Williams (1927)	Hobbs and Price (1940)	Hunt *et al.* (1947)	Bartholomew *et al.* (1953)	U.C.W.I. (1955)
Number of cases	30	150	47	49	50
Incidence	(2)	(0·7)	(0·5)	—	(2·5)
Abortions	—	33 (22)	8 (17)	—	3 (6)
Bleeding during pregnancy	—	33 (22)	26 (55)	19 (28)	1 (2)
Hydrorrhoea	—	4 (2·6)	7 (15)	—	0
Premature rupture of membranes	—	—	15 (32)	—	0
Premature births	—	23 (16)	10 (21)	—	5 (10)
Foetal survival rate	—	101 (67)	36 (74)	—	46 (92)
Retained membranes	—	—	—	—	4 (8)
Manual removal of placenta	—	12 (8)	—	—	1 (2)
Post-partum haemorrhage of 560 ml. or more	—	—	—	—	11 (22)

Aetiology

The study of the histological structure of these rings is complicated by the fact that frequently they are composed of dense, white tissue in which little or no detailed structure is discernible. Many theories of their aetiology were enunciated by European authors of the latter part of the last century, who evinced great interest in both the aetiology and the clinical significance of the condition.

Williams (1927), in the first paper written in English on the subject, summarized ten theories which had been propounded between 1885 and 1909. His own views have influenced nearly all subsequent writers, and, as far as the histology and aetiology of the condition are concerned, are still largely accepted. He postulated that the chorion frondosum, by reason of some defect in ovum or decidua, became too small to support the demands of the growing ovum. Compensation was made for this by a lateral growth of villi into the adjacent decidua vera which was thus split into a basal and a superficial layer; the former was continuous with the decidua basalis, but the latter formed a layer over the peripheral aspect of the placenta which lay outside the chorionic plate. As the foetus and its sac grew larger, the membranes became pressed against this decidua, and loosely attached to it, this area constituting that part of the surface of the placenta which lies outside the ring (Fig. 2).

We have found this decidua splitting theory unsatisfactory in three significant respects. Firstly, it fails to explain the most striking feature of the circumvallate placenta, namely, the undermined appearance of the ring (Fig. 1). Splitting of the decidua vera adjacent to the placenta could only produce a flat peripheral ring with, at most, a slightly raised unfolded edge.

Secondly, we have been unable to demonstrate that "the ring is composed of folded foetal membranes" (Williams, 1927). In our material, the ring is composed of flattened, usually fibrotic, but quite definitely recognizable placental tissue covered on the foetal side by chorion and amnion and continuous with the rest of the placenta peripherally (Figs. 3 and 4).

Lastly, the decidua-splitting theory as stated by Williams ignores the placenta marginata as "having nothing in common with the condition under discussion". We have repeatedly noted the circumvallate type of ring merging into the marginate type (Fig. 6); and we believe that they are both the result of bleeding at the edge of the placenta early in pregnancy. Bartholomew and his colleagues (1953) have pointed out that "when erosive action of chorionic tissue on decidual arterioles permits free pressurized flow of blood upwards through the intervillous spaces to the chorionic plate, thence outward in all directions beneath the chorionic plate to the periphery of the placenta, the flow meets resistance at the junction of the decidua reflexa and vera. Apparently, at this point, the decidua may be unable to contain the pressure of the maternal blood stream and a break-through occurs." If this should happen the blood may pass in any of three directions. It may pass to the exterior between the chorion and the uterine wall. It may invade the chorionic plate, and, if the pregnancy continues, this will result in the appearance of a marginate placenta with its peripheral flattened ring of putty-like material derived from the fibrin and separating the membranes from the underlying placenta. Or the blood may strip up the placenta from the decidua basalis; if it does so to a marked degree, death of the foetus and abortion will be the result. If only the edge of the placenta is separated, it will curl up upon itself, and later, as the amnion and chorion are folded more firmly against it by the enlarging foetal sac, the curled up edge of the placenta will be flattened out to form the typical undermined ring of the circumvallate placenta (Fig. 5). The chorion will remain attached to the original edge of the chorionic plate and will therefore pass over the outer aspect of the definitive placenta to which it will be but weakly adherent, to a point somewhere near the inner margin of the ring (Fig. 5).

In this manner we can account for the gross anatomical appearances of the circumvallate placenta, namely, the undermined and raised ring and the absence of superficial blood vessels outside it: for the microscopic appearances, namely, the chorion overlying but not firmly attached to the periphery of the placenta and the presence of placental tissue in the substance of the ring. The association of the

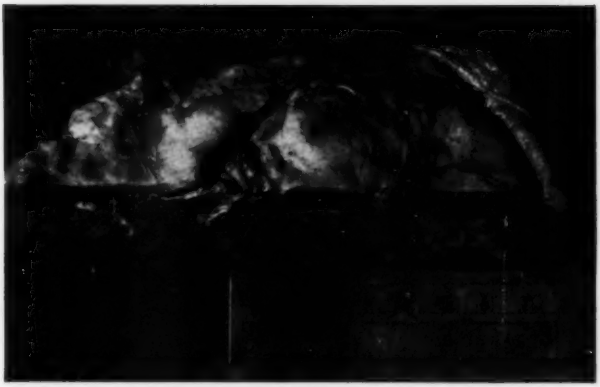

FIG. 1

Placenta Circumvallata. Note the marked undermining of the ring which is raised well above the placental surface.

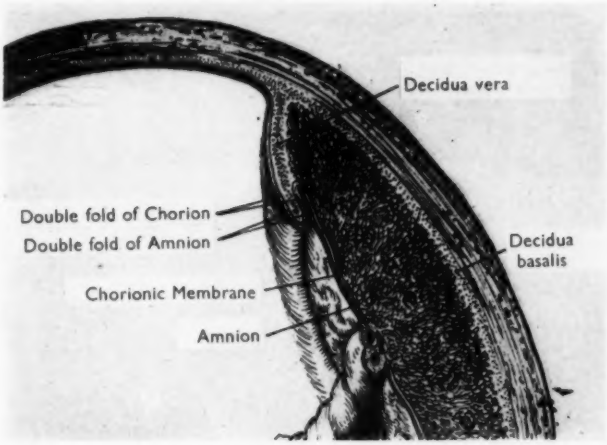

FIG. 2

Part of an illustration from Whitridge Williams's paper demonstrating the decidua splitting theory. Note that there is no placental tissue shown in the fold but only decidua vera. Contrast with Figures 3 and 5.

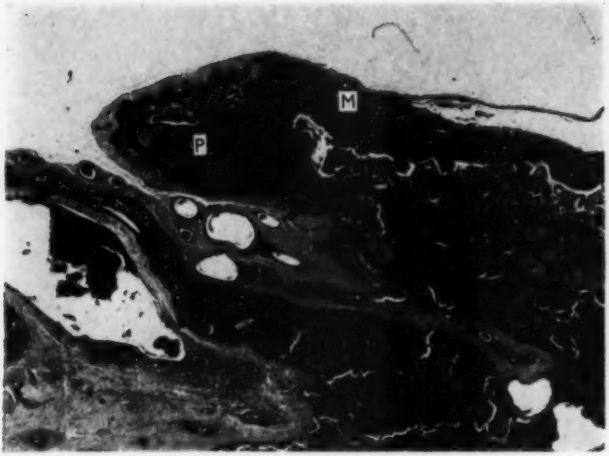

FIG. 3

Photomicrograph of a circumvallate fold. Note the placental tissue (P) in the substance of the fold. Most of the villi are embedded in hyaline material but are still recognizable. There is no decidual tissue in the centre of the fold. ×12.

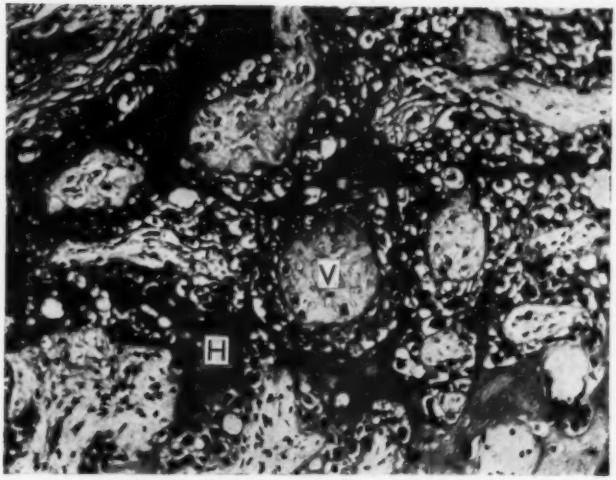

FIG. 4

Higher power photomicrograph of the same fold as in Figure 3 showing placental chorionic villi (V) embedded in hyaline tissue (H). ×150.

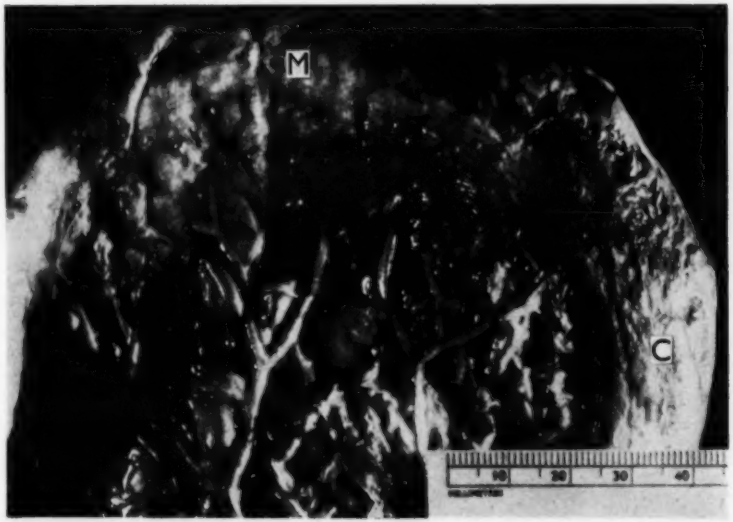

FIG. 6

Placenta showing a circumvallate fold (C) gradually merging into a marginate type of ring (M). Note the raised undermined appearance of the circumvallate ring and the flat unfolded nature of the marginate ring. There are no surface blood vessels seen beyond the margin of either ring.

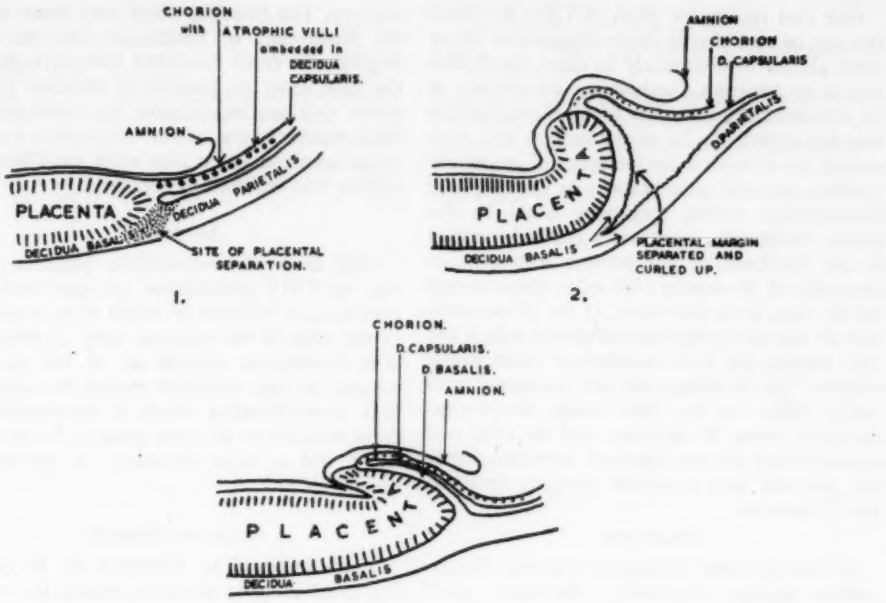

FIG. 5

Diagram to illustrate the development of the circumvallate ring due to separation of the edge of the placenta.

two different types of placental ring, marginate and circumvallate, which may occur in the same placenta can also be accounted for in this way, since the bleeding at one point may be sufficient to separate the placenta from its decidual bed, while at an adjacent point it may merely infiltrate the chorionic plate leaving a fibrinous deposit in it.

CLINICAL SIGNIFICANCE OF THE CIRCUMVALLATE PLACENTA

There is little unanimity of opinion among writers on the subject as to the clinical significance of placenta circumvallata. The earlier European workers noted an increased tendency to abortion, intermittent haemorrhage (Küstner, 1884; Schwab, 1895), and abnormalities of the third stage (Herff, 1896). Williams (1927) stated that in his experience placenta circumvallata was practically without clinical significance, and was to be regarded merely as an interesting anatomical condition. But subsequent writers on the clinical aspects of the condition have emphasized its association with abortion, intermittent bleeding during pregnancy, ante-partum haemorrhage and a foetal mortality rate as high as 33 per cent (Hobbs and Price, 1940); and with hydrorrhoea gravidarum and premature labour (Hunt *et al.*, 1947). Pathologists are less emphatic about its clinical importance; thus Hellman (1947) comments: "usually the extra chorionic portion of the placenta is only 2–3 cm. in depth and so of little clinical significance." He quotes Hertig as stating that ante-partum haemorrhage may be frequently associated with circumvallate placenta. Potter (1952) is of the opinion that, while the stillbirth rate is slightly higher with the most severe forms, the milder varieties are accompanied by no increase in mortality.

Our own results are given in Table II. From this can be seen that in those pregnancies which went almost or completely to term, the foetus was at no apparent disadvantage on account of its abnormal placenta. The foetal mortality rate was not raised. As far as the mother was concerned, no increase in the incidence of premature rupture of the membranes or intermittent haemorrhage during pregnancy could be detected. There was, however, a marked increase in the incidence of post-partum haemorrhage in excess of 20 ounces (560 ml.); thus, among the 47 cases at or near term, 11 (or 23 per cent) lost 20 ounces or more as compared with 6 per cent among the total number of cases under review. This bleeding was not associated with undue delay in the third stage, its average duration being 20 minutes, and in only one instance was manual removal necessary, after the placenta had remained partially attached for 75 minutes.

Diagnosis

It is not possible to diagnose placenta circumvallata during pregnancy. Repeated small haemorrhages or discharges of liquor are suggestive but the diagnosis can only be confirmed by inspection of the placenta after delivery. The bleeding which may occur during the latter half of pregnancy may be indistinguishable from inevitable haemorrhage, and the case must be treated as placenta praevia unless this can be excluded by radiological or other means. In one of our cases severe haemorrhage occurred at the 28th week and Caesarean section was required to control it.

Summary

Fifty cases of circumvallate placenta occurring in 2,019 pregnancies are discussed. The condition is believed to result from separation of the edge of the placenta early in pregnancy with subsequent curling up of the placental margin. In the antenatal period the condition may cause bleeding which is indistinguishable from that due to placenta praevia. In our series there was a high incidence of post-partum haemorrhage.

Acknowledgments

I am indebted to Professor D. B. Stewart for much helpful criticism during the writing of this paper, and to the Editors of the *American Journal of Obstetrics and Gynecology* for permission to reproduce Figure 2.

Table II

Effect of Placenta Circumvallata on the Mother and Foetus in 50 Consecutive Cases

Effect on the Mother		
Haemorrhage during pregnancy	4	3 incomplete abortions 1 severe haemorrhage at 28 weeks
Premature rupture of membranes	3	all artificial rupture of membranes for toxaemia
Abnormalities of the 3rd stage:		
(a) *Retention of membranes*	7	partial
	4	complete
(b) *Retention of placenta*	2	
(c) *Post-partum haemorrhage of 20 ounces or more*	11	22 per cent (average of all deliveries 6·2 per cent)
Maternal mortality		nil
Effect on the Foetus		
Abortion	3	at 20, 24 and 24 weeks respectively
Intra-uterine death	1	hysterotomy for ante-partum haemorrhage at 28 weeks
Neonatal death	1	prematurity; severe pre-eclamptic toxaemia; anuria
Prematurity	2	severe ante-partum haemorrhage; severe pre-eclamptic toxaemia
Average birth weight		7 pounds 3 ounces (3,220 g.); (average of all births 6 pounds 15 ounces (3,108 g.))
Foetal survival	46	

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UTERO-ADNEXAL INFARCTION IN PREGNANCY*

An Unusual Complication of Soap-induced Abortion

BY

JAMES ELSTUB, M.D., M.R.C.O.G.

Assistant to the Obstetric Unit

University College Hospital, London

INTRODUCTION

UTERO-ADNEXAL infarction has been recognized on the Continent for over three decades as a rare complication of induced abortion.

It consists essentially of a sudden thrombosis of the venous channels draining the uterus, usually the result of soap solution gaining access to the maternal sinuses behind the placenta. The uterus and adnexa become infarcted, with extravasation of blood into the myometrium and gross engorgement of the ovaries and tubes which turn almost black. The appearance in the fully developed case is so dramatic and so unlike any other pelvic lesion that it is surprising to find that hitherto only one case has been reported in English (Young and Walker, 1947).

It is proposed therefore to report another case and to review the literature of this condition.

CASE REPORT

The patient was a married woman, aged 26, who had had one normal confinement at term in 1945 and one 3-months abortion followed by evacuation of the uterus in August, 1951. Her menstrual periods were irregular, with a cycle of 5/21–28 days. The last menstrual period started on 3rd February, 1952, 13 weeks before admission.

She was admitted to the West Middlesex Hospital on the morning of 3rd May, 1952 complaining of slight vaginal loss and severe lower abdominal pain which had started 11 hours previously. The patient strongly denied any attempted interference with the pregnancy but stated that she was accustomed to douching herself nearly every day with a solution of "Dettol" in water. For this purpose she used a "whirling spray" douche apparatus. The last occasion upon which she had done this was approximately 30 hours before the onset of symptoms.

Condition on Admission

The patient was pale, but not jaundiced or cyanosed. She was restless and in great pain. The temperature was 99° F., pulse rate 92 per minute and blood pressure 100/70 mm. Hg. The tongue was furred and rather dry. There was extreme lower abdominal tenderness with guarding and rigidity in both iliac regions and slight distension with shifting dullness was demonstrable in the flanks. A firm, tender, midline swelling rose out of the pelvis to the height of a 14-weeks pregnancy.

On vaginal examination the swelling was identified as a pregnant uterus which was firmer than normal and acutely tender. There was an ill-defined tender mass in the pouch of Douglas extending round to both lateral fornices. On speculum examination the cervix was normal in colour and was closed, but a little dark blood was seen coming from the external os.

Although the patient had not recently emptied her bladder, catheterization yielded only 2 ounces of port-wine-coloured urine which contained a moderate number of red cells and 700 mg. per cent protein. It was sterile on culture. On spectroscopic examination methaemoglobinuria was demonstrable.

Examination of the blood revealed the following:

Haemoglobin 82 per cent.

White cells 40,000/c.mm. with 90 per cent polymorphs, 8 per cent lymphocytes and 1 per cent monocytes.

Diagnosis

The patient's pallor, combined with evidence of free fluid in the abdomen suggested that intra-abdominal haemorrhage had occurred. The source of such bleeding was by no means clear, but perforation of the uterus and ruptured ectopic or angular pregnancy were the most likely diagnoses. An immediate laparotomy was decided upon.

Operation

The patient was examined vaginally under general anaesthesia on 3rd May at 2 p.m. without any further clarification of the picture, and a laparotomy was performed, 15 hours after the

* This case was discussed and the specimen shown at a Pathological Meeting of the Section of Obstetrics and Gynaecology of the Royal Society of Medicine on 23rd May, 1952.

FIG. 1

Photograph of the operation specimen after fixation. The left ovary has become detached. The discoloured state of the remaining adnexa is apparent.

FIG. 2

A sagittal section through the uterus. The engorged state of the uterine wall at the placental site, and the separation of the low lying placental edge can be seen.

onset of symptoms and 4 hours after admission to hospital.

About one pint of fresh blood was lying free in the peritoneal cavity. The uterus was enlarged to the size of 14-weeks pregnancy and was congested and cyanotic. Both tubes were black and shone like polished ebony. They were club-shaped, engorged to three times their normal size and blood was dripping from the abdominal ostia. The ovaries were enlarged to the size of golf balls and they too were black and shining. They lay, together with the outer ends of each tube, in the pouch of Douglas, forming the mass which had been felt vaginally.

The ovarian veins were palpably thrombosed and could be recognized as hard cords approximately 2·5 cm. thick on either side running out to the pelvic wall in the infundibulo-pelvic ligaments. The uterine veins were not apparently affected, but there was some extravasation of blood into the broad ligament.

A total hysterectomy with bilateral salpingo-oöphorectomy was performed, no special difficulties being encountered with the thrombosed vessels. During the course of the operation the patient received one pint of matched blood by intravenous drip infusion.

Post-operative Course

Surprisingly, the patient did not develop oliguria and there was no further haematuria. There was some elevation of temperature from the 3rd to the 7th post-operative day and this was thought most likely to be due to the presence of a pelvic haematoma. Sulphatriad was given. The white cell count on the third day had fallen to 14,000/c.mm. of which 80 per cent were polymorphs. Recovery was uninterrupted and the patient was discharged home on 23rd May, 1952. She was seen at the follow-up clinic on the 7th July and on the 20th October, 1952. Apart from occasional hot flushes, she had no complaints and the pelvic examination was satisfactory.

The Pathological Specimen (Figs. 1 and 2)

In the fixed specimen, the uterus measured 13×8×7·5 cm. The external surface showed an area of dark maroon discoloration covering the greater part of the anterior surface and extending around each cornu. On section, the discoloration was seen to extend throughout the thickness of the uterus, corresponding closely in extent with the placental site. The uterine wall in this situation showed gross dilatation of venous sinuses and diffuse extravasation of blood into the myometrium. The placenta was relatively large and occupied the anterior wall, extending upwards over the fundus to the upper part of the posterior wall and downwards to the internal cervical os. The upper half was dark coloured from haemorrhage, the lower half being normal. There was placental separation for a distance of 3 cm. from the internal os. The uterine cavity was occupied by a foetus measuring 6·6 cm. (crown-rump).

Both tubes were enlarged, maroon coloured, turgid and club-shaped, the right being 10 cm. in length with transverse diameters 1·5×1·3 cm., the left 9 cm. long with diameters 2×1·5 cm. There was also thickening and discoloration of the infarcted ovarian and broad ligaments. The ovaries were similarly swollen and discoloured, on section resembling firm blood clot. They measured: left, 5×3·5×2·7 cm. and right, approximately twice this size.

HISTOLOGY

Placenta

All sections of the placenta showed necrosis, with most of the nuclei failing to stain; in a few areas poorly stained nuclei were still recognizable.

Uterus

The blood sinuses of the myometrium were markedly distended and occupied by recently clotted blood. The walls of the larger sinuses were heavily infiltrated by polymorphonuclear leucocytes. At one area, immediately beneath the placenta there was a narrow zone of necrosis of myometrial fibres.

Sections of the uterine artery and vein on each side showed them to be distended by recently thrombosed blood.

Fallopian Tubes

The entire thickness of the wall of both tubes and the broad ligaments were densely infiltrated by extravasated red blood corpuscles. The vessels showed dilatation by clotted blood.

Ovaries

Both ovaries were extensively infiltrated by red blood corpuscles, the tissue only being recognizable as ovarian by the presence of follicles, follicular cysts, corpora albicantia and a corpus luteum on the right side. The ovarian vessels were thrombosed.

Review of the Literature

Von Geppert (1921) was probably the first to describe utero-adnexal infarction fully and to recognize its pathology. Before this time the condition had been called "Alkaline Necrosis of the Uterus" and in fact this name remained popular until 1935 when the literature was reviewed by Mondor, Lamy and Leroy (1935). From then onwards the term utero-adnexal infarction gained wide acceptance on the Continent, and, whilst the total number of cases adequately reported remains small, the literature abounds with brief references to it. Oddly enough the term receives no mention in the English literature, although the paper by Young and Walker (1947) clearly describes the condition.

The original review of Mondor, Lamy and Leroy (1935) referred to 15 cases, nearly all of German origin, and from the literature since that time reports of a further 13 cases have been collected (Mocquot and Bénassy, 1936; Mondor, 1937; Guibal and Richon, 1945; Young and Walker, 1947; Turettini, 1948; Solal and Bouchara, 1954).

From a study of these authors it is possible to give a general description of the condition.

The Clinical Picture

In nearly all the cases the pregnancy had progressed beyond 12-weeks gestation. Nine out of the 13 patients in the present series confessed, sooner or later, to having douched themselves with a solution of soap and water. In about half the cases the onset was dramatic, with immediate collapse, dyspnoea, cyanosis and severe abdominal pain. In the remainder it was gradual, resembling at first a straight-forward abortion with moderate abdominal pain and some vaginal bleeding. In one of Turettini's cases the onset was delayed for as long as 5 days. However, after a variable interval there was rapid deterioration in the patient's condition with the development of severe pain and signs of shock. By the time the patient had been admitted to hospital there was a high pulse rate but surprisingly little pyrexia (Mondor, 1937). Some of the patients were jaundiced.

The abdomen was distended and very tender with sub-umbilical guarding and rigidity. The uterus was usually exquisitely tender, palpably enlarged to the size of between 12- and 16-weeks pregnancy and was bigger and harder than would have been expected. Only rarely was the presence of free fluid detected and an even less common finding, but diagnostic when it occurred, was the presence of large ecchymotic patches on the trunk and limbs (Mondor, 1937).

Vaginal examination was usually difficult owing to the extreme tenderness of the uterus and the fornices, but in most cases it was possible to identify the enlarged, hard, tender uterus. Adnexal masses, however, were seldom palpable. The cervix usually appeared normal, but in 2 cases, where the infarction was very extensive, speculum examination revealed gross discoloration of the portio vaginalis, varying from a grey necrotic appearance to black (Mocquot and Bénassy, 1936; Turettini, 1948).

When the bladder was catheterized, oliguria with blood-stained urine containing albumen, red cells and methaemoglobin was a not infrequent finding.

The Findings at Laparotomy

There was usually either a little serosanguinous fluid in the peritoneal cavity or frank blood. In the worst cases the whole of the pelvic peritoneum was discoloured green or blue-black, even extending up the anterior abdominal wall as far as the umbilicus (Turettini, 1948, Case 5). Typically, the uterus was large and firm with blotchy bluish discoloration of its surface, very much like the appearance of utero-placental apoplexy later in pregnancy (Young and Walker, 1947). In other cases the uterus looked merely congested and cyanosed. One or both tubes were always affected. They were enlarged, turgid and engorged with blood, varying in colour from a dark reddish blue to black, rather like strangulated gut. The French writers have aptly likened

them to the aubergine (egg-plant) which they resemble both in shape and colour. The ovary on the affected side was also enlarged and discoloured. Where such changes were found in the adnexa, the ovarian vessels in the ovario-pelvic ligament were found to be greatly enlarged and palpably thrombosed and there was often extravasation of blood into the broad ligament.

Histology

The microscopic appearances of the uterine wall and of the tubes and ovaries were those of infarction with little or no inflammatory reaction in the early cases. Dilatation of the venous channels and capillaries with extravasation of red cells into the surrounding tissues was characteristic. The veins draining the affected areas were thrombosed as were frequently the accompanying arteries. From the engorged state of the veins and of the tissues they drained, it was evident that venous rather than arterial thrombosis was the cause of the infarction. It was common to find that the placenta had been separated from the uterine wall over part of its surface and it was generally considered that this was the route whereby the soap solution had entered the uterine veins. In the occasional case there was evidence of a douche nozzle having entered the tissues in the region of the internal os, thus allowing more direct access to the myometrial veins (Heller, 1949). Where there was delay in operating, evidence of infection of the uterine wall and even areas of necrosis were present. Pelvic peritonitis with abscess formation and perforation of the necrotic uterine wall sometimes followed. This resulted in errors of diagnosis because the original picture of infarction became obscured by the inflammatory changes (Runge, 1927).

Treatment and Mortality

Of the total of 29 cases, including those reviewed by Mondor *et al.* (1935), 19 were subjected to laparotomy and either total or subtotal hysterectomy. Eight patients died and 11 survived. The 10 patients who were not operated upon died. Thus only 11 out of 29 survived.

This picture is not quite so gloomy, however, when we consider the 13 cases collected since 1935. Of these, 11 patients were subjected to hysterectomy, 8 survived and 3 died; 1 during the operation from shock (Solal and Bouchara, 1954) and the other 2 subsequently from renal failure (Turettini, 1948, Case 4; Young and Walker, 1947). The 2 who were not subjected to hysterectomy also died, one being curetted and dying of sepsis (Mocquot and Bénassy, 1936), the other dying of air embolism before admission to hospital, but showing definite evidence of utero-adnexal infarction at necropsy (Turettini, 1948, Case 3). It is clear from this that hysterectomy has been considered the treatment of choice by the great majority of writers and, although the mortality was high, it has compared favourably with the results of conservative treatment. However, no reliable comparison can be drawn, since the diagnosis can rarely be made with certainty except at laparotomy or necropsy and therefore the results of successful conservative treatment are much less likely to be reported.

Causes of Death

The cause of death has already been stated for the more recent series, namely, sepsis in 1 case, renal failure in 2 cases and air embolism in 1 case. This latter cause cannot, however, be held to be the result of utero-adnexal infarction. It probably occurred as a result of introducing soap bubbles into the uterus by means of a Higginson's syringe, the air then gaining access to the maternal venous system of the uterus via the placental sinuses. Turettini (1948) suggests that the early signs of infarction found at necropsy in this case were due to the direct action of the soap on the uterine veins.

In Mondor's series it is less easy to assess the causes of death, but it can be said that the majority of patients died of renal failure while the others died of shock and sepsis.

Discussion

There is no doubt that, in the majority of recorded cases of utero-adnexal infarction, vaginal douching with soap solution in one form or another has been admitted. In many cases it has been the only form of interference, although in some the patient has tried a variety of other abortifacient procedures. But the common

factor in nearly all cases has been the soap solution. In the present case, the patient was in fact unaware that she had used soap solution as a douche, stating that she had used only "Dettol" and water. Enquiry from the manufacturers however revealed that "Dettol" as sold to the public consists of "chlorinated Xylenol and aromatic essential oils dissolved in a neutral soap solution".

The fact that soap is a haemolysing agent and a protoplasmic poison has long been recognized (Runge, 1927) but the precise means whereby infarction is brought about as a result of douching with soap solution remains dubious. The probable sequence of events would appear to be as follows. A Higginson's syringe may be used, in which case either the nozzle is inserted into the cervical canal or some sort of vulval shield or pad is used to prevent return of the fluid and thus distend the vagina under pressure. The "whirling spray" apparatus such as was used in the present case is well adapted to this purpose in two respects: it has a very large, strong, rubber bulb, and it has a conical rubber obturator moulded around the base of the cannula which can be pressed firmly against the vaginal introitus. Thus water may be pumped into the vagina with considerable force and its escape is prevented. In the pregnant patient distension of the vagina with fluid under pressure may be sufficient to drive the fluid through the cervical canal into the uterus. A similar mechanism is known to occur with powder insufflation for vaginitis in pregnancy and several deaths from air embolism have resulted from this procedure (Pierce, 1936; Partridge, 1943; Breyfogle, 1945; Cook, 1950).

Soap solution having gained access to the uterine cavity, one of several paths may be followed. Firstly, the ovum may rupture, allowing the fluid to enter the amniotic cavity and resulting in foetal death followed by abortion. Secondly, the fluid, perhaps having entered the uterus at low pressure and in small amount, may separate part of the ovum from its attachments to the uterine wall and by its irritative properties initiate vigorous uterine contractions, probably ending in abortion. In the third type of case the fluid may by-pass the ovum and traverse the uterine cavity to the tubes and peritoneal cavity causing peritoneal irritation or infection. Finally, the soap solution may separate the placenta from its attachment to the uterine wall and gain access to the intervillous sinuses, thus entering the maternal venous system. It is now that thrombosis and infarction may arise; this is the mechanism with which we are concerned.

Once having gained access to the maternal blood stream, soap may act locally in two ways to produce infarction. Runge (1927) mixed a solution of 5 per cent soft green soap with an equal quantity of venous blood and found that haemolysis immediately occurred, the mixture becoming dark purple and gelatinous. It is not improbable that something similar could occur leading to occlusion of the veins in and about the uterus and adnexa. At the same time soap may act directly on the intima of the vessels causing necrosis which would further contribute towards thrombosis (Mondor, 1937). As Mondor has also indicated, the fact that little or no inflammatory reaction is to be found around the thrombosed vessels is clear evidence that it is not infection which causes the thrombosis.

Once parts of the main venous drainage of the uterus and adnexa are occluded in this way, it is to be expected that the capillary pressure in the area affected will rise under the influence of continuing arterial blood flow. Local anoxia will lead to tissue necrosis and capillary rupture, with extravasation of blood. Thus is produced the picture of haemorrhagic infarction, even though the mechanism is not the same as that more commonly encountered in other organs. Sooner or later the arteries too become thrombosed, whether by retrograde spread or by diffusion of the soap through the tissues is uncertain. Turettini (1948) has remarked that when performing a hysterectomy upon these cases there is so little bleeding that the use of clamps is hardly necessary. This phenomenon was very noticeable in the present case.

Utero-adnexal infarction has seldom been observed before the twelfth week of pregnancy and Mondor has suggested that the reason for this is that the placenta and its underlying maternal venous sinuses are not formed until this time. Whilst this is true, it must only be a matter of degree, since the maternal sinuses are

but a localized development of the chorio-decidual space, through which maternal blood circulates from very early in the life of the ovum. An alternative explanation may be that the ovum does not completely fill the uterine cavity until about 12 weeks, after which time the decidua vera and the decidua capsularis become fused. Until this happens, it is likely that any fluid which might gain access to the uterus would surround the ovum and enter the tubes, without penetrating the wall of the ovum to reach the chorio-decidual space.

Once the placenta has developed, and the decidual space has been obliterated by fusion of decidua vera and capsularis, it is reasonable to suppose that a placenta praevia is much more vulnerable to an assault by douching than is a normally situated placenta. The specimen taken from the patient in the case here presented clearly showed separation of the lowermost inch of the placenta which reached the level of the internal os. The literature does not help on this point, the site of placental insertion not usually being specified. If it were to be assumed that a low lying placenta was almost a *sine qua non* for the development of utero-adnexal infarction after douching with soap solution then this might explain the relative infrequency of this accident.

It is pertinent to enquire why, if soap is such a toxic substance when introduced into the uterus, there have been no reports of cases of utero-adnexal infarction occurring after therapeutic abortions using intra-uterine soap paste. Two small series of such therapeutic abortions have been published in England (Barns, 1947; Williams, Danino and Davies, 1955). In neither series was utero-adnexal infarction encountered, although, in the latter, 2 cases are cited in which intravascular haemolysis occurred, presumably as a result of the soap gaining access to the blood stream. In the American literature, however, there are many reports of patients dying from the criminal application of this technique. Some patients died immediately from air or soap embolism but others (Weilerstein, 1944; Strauss and de Nosaquo, 1945) died after a more or less prolonged illness featuring pelvic sepsis and septicaemia. In each case necropsy showed large areas of necrosis in the uterine wall. It seems quite possible that these findings were the late result of infarction. Probably the reason why infarction has not been reported following the therapeutic use of soap paste, is that more care is taken over its injection. The usual technique is to introduce the paste very slowly, even more slowly than its viscosity dictates. Rates of 2–3 ml. per minute are not usually exceeded. Furthermore, the quantity of paste injected is usually not more than 60 ml. at the most and often much less. When soapy water is injected from a Higginson's syringe, several hundred ml. may be rapidly forced into the uterine cavity.

In a recent paper Solal and Bouchara (1954) challenge the view that soap is the only, or even the most common cause of utero-adnexal infarction in pregnancy. They quote several cases in which the condition arose after attempted abortion by other means including "the passage of a sound", "curettage", "a gum elastic catheter", and the intra-amniotic injection of "serum physiologique". They cite the experimental work of Laporte and Pham (1935) who found that injections of human or horse serum into previously sensitized pregnant animals produced lesions similar to those of utero-adnexal infarction. They speculate as to whether the absorption of serum from a retro-placental clot in a sensitized patient could act in the same way. Some such mechanism, they consider, could also take place in concealed accidental haemorrhage, thus accounting for the similarity of the lesions—both utero-adnexal and renal—in the two conditions. This theory however does not readily explain the relatively rapid onset of utero-adnexal infarction in some of the recorded cases where soap injections have been used, nor is it easy to see in what way the patient may have become "sensitized".

Associated Renal Damage

It is clear from the literature that some degree of renal damage, not necessarily amounting to renal failure, is present in about one-third of the cases reviewed. In the present series, apart from the two patients who died of renal failure, there were at least 3 others (Mondor, 1937; Guibal and Richon, 1945; Solal and Bouchara, 1954) who had oliguria and haematuria, suggesting the presence of renal impairment. In fact Solal and

Bouchara go so far as to state that utero-adnexal infarction occurring in pregnancy is always accompanied by what they, in common wih other French authors, describe as hepato-renal damage. If the evidence in favour of liver damage is somewhat obscure, there can be no doubt of the occurrence of renal impairment and failure. The lesions found at necropsy in the kidneys of patients dying of renal failure are principally those of tubular degeneration, with or without deposition of blood pigments in the tubules (lower nephron nephrosis). Young and Walker (1947) describe the lesions in some detail in their own case and compare their similarity to the lesions found in incompatible blood transfusion, the "crush syndrome" and some cases of concealed accidental haemorrhage. The same lesions are commonly found in patients dying of renal failure following *Clostridium welchii* septicaemia. It is doubtful if any single factor will explain the similarity of the lesions in these 5 different syndromes but one or other of two conditions is always present. These are massive tissue destruction and intravascular haemolysis. In cases of utero-adnexal infarction, both factors are commonly found. A heavily infarcted uterus might be supposed to provide enough tissue destruction to affect the kidneys in much the same way as a crushed limb in the crush syndrome (Bywaters and Dible, 1942). Where intra-uterine injections of soap solution have caused the infarction, soap gains access to the maternal venous system and causes intravascular haemolysis. This presumably may affect the kidney in the same manner as does an incompatible blood transfusion.

In the present case, the patient had scanty urine and methaemoglobinuria on admission to hospital, but after the operation her urinary excretion was normal. On these findings alone one cannot say whether, in fact, any renal damage had occurred and there is no means of telling whether the relatively early operative intervention averted or halted such a process. It may be that the methaemoglobinuria was formed in the bladder from haemoglobin derived from the surrounding intense pelvic congestion. The relatively small amount of urine first found in the bladder may also be explained by the initial state of shock.

Diagnosis

It is probable that in order to avert renal damage, early diagnosis and treatment are essential. Despite the fact that in over half the reported cases, including the present one, the diagnosis was not made until laparotomy revealed the true state of the pelvic organs, it should be possible to make an early diagnosis if only the condition is kept in mind. When the clinical signs suggest some intra-abdominal catastrophe such as a ruptured ectopic pregnancy, the abdomen will, in any case, be opened and the correct diagnosis reached. If, on the other hand, the condition is thought to be a septic abortion with pelvic peritonitis, conservative treatment will be adopted and valuable time may be lost. It is to this kind of case then that special attention should be directed.

The following points are tentatively put forward as indicating the possibility of utero-adnexal infarction having occurred in a case which otherwise suggests septic abortion with pelvic peritonitis:

(1) A history of collapse immediately after douching, associated with localizing signs in the pelvis.

Before attributing the collapse to utero-adnexal infarction, however, it is important to exclude the possibility of cerebral or pulmonary soap bubble embolism. In the former condition the patient exhibits signs of cerebral irritation followed later by localizing neurological signs. In the latter event, there is immediate dyspnoea and cyanosis with evidence of pulmonary oedema. Whilst either of these conditions may arise coincident with utero-adnexal infarction, they would both render surgery extremely hazardous.

(2) A high pulse rate and white cell count with relatively little pyrexia (Mondor, 1937).

In the present case the patient's temperature was 99° F. on admission to hospital and, whilst the pulse rate was not particularly high at 92 per minute, the white cell count of 40,000 per c.mm. was very striking.

(3) A very tender large uterus associated with tender adnexal masses in a case of recent onset.

In septic abortion, the uterus is not commonly enlarged beyond the expected size—in fact it is

usually smaller owing to some of the uterine contents having been previously expelled—and whilst it is always tender, it does not attain the exquisite degree of tenderness found in utero-adnexal infarction. Tender adnexal masses may well be found in septic abortion but they are not an early finding.

(4) The presence of jaundice or oliguria with haematuria.

Where these signs occur in association with abortion it is usual for *Cl. welchii* to be held responsible, but not uncommonly the organism is isolated only from the vagina and not from the blood stream. In such cases it seems possible that soap haemolysis or utero-adnexal infarction might be to blame rather than an organism which is quite frequently found in the vagina of healthy women.

(5) Evidence of free fluid in the abdominal cavity.

This was found in the present case and in a few of the other reported cases. However, Mondor *et al.* (1935) have condemned diagnostic colpotomy in suspected cases, for a positive finding is too infrequent to be useful, and a negative finding is apt to lead to a false sense of security.

(6) An abnormal discoloration of the cervix, as described by Mocquot and Bénassy (1936). This did not occur in the present case, and indeed is rarely encountered. Where the cervix does appear to be blackish in colour it would be as well to exclude the possibility that the patient had been inserting potassium permanganate tablets into the vagina, for this is well known to cause discoloration and ulceration of the tissues.

Where the condition is discovered at operation for some other suspected abdominal catastrophe, there should be little difficulty in recognizing it. The whole picture is so striking that one should not mistake it for anything else. The only cases which might give rise to difficulty are those in which there is unilateral infarction of the adnexa without gross changes in the uterus. Here the engorged and blackened tube may at first sight appear to be the result of torsion, but no twist will be demonstrable.

Treatment

There appears to have been general agreement amongst previous writers that the infarcted tissue should be removed as early as possible. In practice this usually involves hysterectomy together with removal of one or both adnexa. To the naked eye the uterus is often much less obviously damaged than the adnexa, but nevertheless, the consensus of opinion favours its removal. Subsequent histological examination has always shown considerably more uterine involvement than might have been expected. Since, however, the condition has seldom been diagnosed except at laparotomy, it is quite possible that cases with less extensive infarction may have passed undiagnosed and it would be unwise to dogmatize on the basis of the evidence so far available.

Where the ovaries are obviously infarcted, as in the present case, there can be no choice but to remove them despite one's reluctance to do so in a young woman. By leaving them, infection of the dead tissue would follow, and with obliteration of their blood supply there could be little hope of their retaining their function.

In the majority of the cases reviewed, subtotal hysterectomy was performed whereas a total hysterectomy was done in the present case. There is little benefit from leaving the cervix, but it can readily be appreciated that in the past, before the advent of antibiotic drugs and blood transfusion, much was to be gained by performing a rapid operation such as subtotal hysterectomy. The advantage of removing the cervix in these cases is that it permits drainage through the vaginal vault, for there is always the risk of infarcted tissues having become infected by the time of operation.

Anticoagulants were not used in the present case, nor are they referred to in the literature. It is difficult to predict what results would follow their use and on the whole one feels that, whilst they might prevent the spread of thrombosis in the very early case, they might just as easily cause extensive and intractable intra-abdominal haemorrhage.

Since renal failure has been the commonest cause of death in this condition, treatment must be directed to minimizing the risk. Measures which would seem to be of benefit are early

restoration of blood volume in those cases presenting with shock, the immediate removal of severely damaged pelvic organs and perhaps the institution of caudal block anaesthesia. Until more cases have been reported where modern methods of treatment have been tried one can only speculate as to the possible benefits.

Once renal failure develops, however, it is probable that much can be done along the lines laid down by Bull, Joekes and Lowe (1949), to keep the patient alive until the renal tubules regenerate and function is restored.

Conclusion

Utero-adnexal infarction is a rare but extremely dangerous complication of induced abortion. In the majority of cases it follows intra-uterine injections of soap solution and is due to thrombosis of the uterine and ovarian veins. This leads to haemorrhagic infarction and tissue necrosis of the areas involved. The adnexa, for some reason as yet unexplained, are always more affected than the uterus. The tubes present a striking picture, being swollen and engorged with blood to more than twice their normal size and having a shining blue-black appearance like that of an aubergine (egg-plant). The uterine wall is also affected, varying from an engorged cyanotic mottled appearance to that of frank utero-placental apoplexy with haemorrhages over its surface.

Early diagnosis depends upon an awareness of the condition whenever an induced abortion is encountered. Prostration, extreme abdominal tenderness and a high pulse rate with relatively little pyrexia are very suggestive signs.

The sole treatment is removal of the infarcted tissues by hysterectomy and extirpation of one or both adnexa.

A common complication of the condition is renal failure due to lower nephron nephrosis. It is hoped that early diagnosis and modern methods of treatment will help to reduce the very high mortality of this complication.

Summary

(1) A case of utero-adnexal infarction is described.

(2) The literature of the condition is reviewed.

(3) The pathology, diagnosis and treatment are discussed.

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ON THE STRENGTH OF THE MEMBRANES

BY

M. P. EMBREY, M.D., F.R.C.S., M.R.C.O.G.

First Assistant

Nuffield Department of Obstetrics and Gynaecology, University of Oxford

RECENT experiments which I described (Embrey, 1954) to determine the tensile strength of the membranes have aroused comment by Danforth, McElin and States (1956). The principle of these experiments was to distend to bursting point the membrane placed over the end of an open cylindrical vessel and (since the distended membrane formed the segment of a sphere) substitute the appropriate values in Laplace's formula:

$$T = \frac{PR}{2} \text{ where } \begin{matrix} P = \text{pressure at bursting point.} \\ R = \text{radius of sphere.} \end{matrix}$$

In 135 cases examined the average tensile strength of the membranes was 168900 ± 28800 dynes/cm.

It was noted with interest that the results compared closely with those of Matthews Duncan (1868) who performed similar experiments almost 100 years ago, while a parallel could also be drawn with estimates of the uterine force in labour obtained by other means.

On the other hand, it was disquieting to learn of the differing results of Danforth, McElin and States (1953) in similar experiments. They stated the average tensile strength of the membranes to be 24 cm. Hg/cm.; but it was apparent from their paper that this result would have been more correctly stated as $24 \times 13 \cdot 7 \times 981 = 322600$ dynes/cm. approx. This figure was almost double my own, which was 168900 dynes/cm. Moreover, Danforth *et al.* noted that their results represented the foetal membranes as being able to withstand a greater force than that normally exerted by the uterus in labour.

Danforth *et al.* (1956) have now objected to the fact that in referring to their work I pointed out that their results were expressed using the "peculiar" and "mathematically incorrect" *standard* of centimetres Hg/cm. While I regret that my words have caused distress I cannot admit that the expression of *tensile strength* as centimetres Hg/cm. is desirable or even accurate,* and I believe that this opinion will be generally shared by all writers interested in scientific precision. At the same time, it must be apparent that in making this observation I was criticizing not their method or calculations (which were similar to my own) but only the *unit* of measurement employed to express their results.

This being so, I feel that the question of the *unit* to be adopted, important as it is, is a "storm in a teacup" compared with the much more important matter of explaining the two-fold discrepancy revealed between our two results.

RE-EXAMINATION OF DATA

I have, therefore, re-examined my material and submitted my data for separate opinion to Professor A. Thom and Dr. J. D. E. Campbell (of the Department of Engineering Science, University of Oxford) who have also had the opportunity of seeing the paper of Danforth *et al.*

This independent investigation has confirmed the correctness of my assumptions and method of investigation, and has not revealed any fault in the calculation and computing of results. In particular, no error involving the introduction or omission of a factor of two has been exposed.

Now in considering further the points at issue it is apparent that the principles involved in the two investigations were essentially similar; viz., the assumption that the distended membrane

* For that matter it is equally incorrect to record *pressure* in "cms. Hg/cm²" as is done by Danforth *et al.* (1953).

covering the end of an open cylinder formed a segment of a sphere and the substitution of the appropriate values in the equation T=PR/2 for a spherical pressure vessel. Here there is no division of opinion. (Inexplicably Banks (1956), while accepting the assumption for both investigations, does so somewhat reluctantly in my case.)

The main difference lies in the size of the cylindrical vessel used—in my case it was 3·75 cm. *radius* while Danforth *et al.* (1953) used one only $\frac{5}{16}$ inch (0·8 cm.) *diameter*. Theoretically, this should have no influence on the result; the pertinent measurement in Laplace's formula is the radius of the spherical bubble (R), not that of the cylinder (r) (Fig. 1). Knowing the radius of the cylinder (r) and the height of the bulge (h) the radius of the bubble (R) can be deduced, but if the latter can be measured directly, the other factors are of no moment.

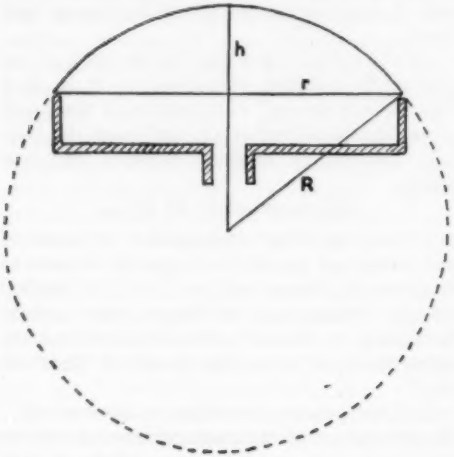

FIG. 1

But one notes with some concern, bearing in mind the small measurements involved, that Danforth *et al.* did not measure the *radius* of the membrane bubble directly but "estimated its *diameter*" by comparing it with a series of templates held adjacent. The accuracy of such a method may be questioned. Unfortunately, no data of pressure readings and bubble sizes recorded were given by Danforth *et al.* in their paper (nor have they since been presented), to enable their calculations to be checked.

In my own experiments, as previously published, the average pressure (p) required to rupture the membranes was 58·9±11·5 mm. Hg. Taking a "typical" reading of 60 mm. Hg and a "typical" deflection of the bulging membrane (h) of 1·5 cm., substitution in the equation gives the calculation

$$T = \frac{PR}{2} = p \times \frac{r^2+h^2}{4h} \times 981 \times 1{\cdot}37 \text{ dynes/cm.}$$
$$= 163000 \text{ dynes/cm. approx.}$$

CAUSES OF ERROR

Speculation as to the explanation of the discrepancy between the two studies is likely to be more intriguing than profitable, and it may be that more than one factor can be incriminated. What little evidence I have indicates that immediate testing of the membranes is not as important as might be imagined. Whether the membrane is tested "chorion up" or "amnion up" may make a difference that only direct experiment can settle. Presumably in both researches the two membranes were tested together and undisturbed, but, as I have pointed out, separate testing of the membranes indicates that there is little strength in the chorion or for that matter in the decidua. Certainly it seems doubtful whether such factors could add up to a "two to one" discrepancy.

There is however a further aspect of the problem which might be considered in any future studies. The assumption that the distended membrane forms the segment of a sphere (agreed in both these studies and in many similar problems) pre-supposes that tension in it is uniform. Unless the membrane is initially stretched this will not be exactly true, the error introduced in the assumption diminishing as the initial tension increases.*

* The behaviour of an elastic membrane under pressure has been the subject of research by Dr. Campbell (1956) but the problem is too complex for introduction here in any detail, while the data are awaiting publication. It is sufficient for the present purpose to state that Campbell has calculated that for an initially unstretched membrane the error might be of the order of 12–14 per cent, while for a membrane with some initial tension in it (as in my experiments) it would be appreciably less.

The opportunity arises for further consideration of another matter:

The Uterine Forces in Labour

In my previous paper I was particularly interested to follow the method of Matthews Duncan (1868) and used the data obtained in the experiments to estimate indirectly the uterine force in labour. Now in so doing it was perhaps not made sufficiently clear that there is a source of error here—namely, to use the average pressure obtained in the experiments (when the radius of the testing cylinder is 3·75 cm.) in a hypothetical calculation concerning the maternal passage (whose radius is 5 cm.).

It can be shown by calculation that an elastic membrane of given tensile strength rupturing at a pressure p in a testing chamber of 3·75 cm. radius will do so at a lower pressure—approximately $\frac{1}{2}$p—in one of 5 cm. radius. Assuming that in labour the membranes rupture at full dilatation of the cervix (when the radius of the birth canal is 5 cm.) the estimate of the uterine force required to rupture them as 6,340 g.wt. or 14 pounds is therefore too high and should read 10½ pounds approximately; on the other hand, the frequency with which the membranes rupture before full dilatation will be remembered.

In any event, it is necessary that the limitations of the method should again be pointed out. It is only useful in so far as it may be presumed that the uterine thrust in normal labour will exceed that required to rupture the membranes.

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PLACENTAL POSITION AND BREECH PRESENTATION

BY

M. R. FELL, M.R.C.S., M.R.C.O.G.

Resident Obstetrician

Queen Charlotte's Maternity Hospital, London

THIS paper is an enquiry into the influence exerted by the site of implantation of the placenta on breech presentation and external cephalic version.

(1) Is the position of the placenta the cause of persistent breech presentation in late pregnancy?

(2) Does the position of the placenta increase either the difficulty or the hazards associated with external cephalic version?

In a previous paper it has been shown (Fell, 1953) that version under anaesthesia, although carrying a definite though small risk to the foetus, is justifiable when the foetal loss from breech delivery exceeds the loss from version and subsequent delivery. One risk of version is accidental ante-partum haemorrhage, and it was suspected that partial detachment of the placenta would be most likely to occur when this organ lies wholly or partly to the front of the uterus, and, further, that a placenta situated in this position would make version more difficult.

It had been claimed (Stevenson, 1949, 1950, 1951) that the site of placental implantation is the cause of breech, transverse and oblique presentations on the theory of accommodation. It is suggested that the foetus accommodates itself to the shape of the amniotic sac, the smaller foetal pole occupying the smaller pole of the sac and *vice versa*. It is well to reflect on which is the smaller pole of the foetus and which the smaller pole of the sac. In the case of a fully extended breech, the breech is the smaller pole, and on the theory of accommodation should come to occupy the smaller pole of the sac. According to this writer, the placenta indents the amniotic sac, altering its ovoid shape. In consequence it determines the polarity of the sac, independently of the fixed polarity of the uterus and thus exerts a determining effect on the presentation of the foetus.

Thus a cornuo-fundally implanted placenta reduces the upper pole of the amniotic sac and so favours the accommodation of the smaller foetal pole. But which is the smaller pole of the foetus—the head or the extended breech? In extended breech presentations, do the legs of the foetus secondarily extend because the presentation is a breech and there is insufficient room in the pelvic brim to accommodate both the legs and the breech at one and the same time, as suggested by Gibberd (1949), or is the extended attitude of long-standing and the cause of persistent breech presentation, as suggested by Vartan (1945)?

Undoubtedly, when the placenta is praevia it may cause displacement of the presenting part and consequently be responsible for a malpresentation. This, however, can be explained by regarding a placenta praevia as a space-occupying mass without having regard to any alteration in shape of the amniotic sac. The more severe the degree of praevia, the greater will be the displacement of the presenting part unless the foetus is small, the pelvis capacious, or the placenta very thin. Such displacement may result in transverse, oblique or breech presentations, or a vertex presentation with the head high above the pelvic brim, and attempts to correct matters are often unsuccessful or only temporarily successful.

This is not the case with breech presentations unassociated with placenta praevia. When external version is attempted at the optimum time, that is, before the foetus has become too large to prejudice the issue, yet is sufficiently large to render reversion unlikely, a breech can usually be converted to a stable vertex presenta-

tion. Certain factors influence the ease or difficulty of attempted external version apart from the size of the foetus. These include the position of the legs and the station of the breech since an extended breech engaged in the brim of the pelvis will resist attempts at version unless the breech can first be disengaged, and extension of the legs *per se* can render version more difficult owing to the splinting effect it produces.

It was considered possible that an anteriorly situated placenta might also prejudice attempted external version and might increase the hazard of accidental haemorrhage resulting from partial detachment of the placenta consequent upon too forceful an attempt at version.

In consequence an attempt has been made to localize the position of the placenta in many cases of breech presentation occurring in Queen Charlotte's Maternity Hospital over a period of 18 months.

In all patients referred for a simple radiological examination and in whom a breech position was found, Dr. Rohan Williams, the Consultant Radiologist, noted the placental position, if this could be determined from the routine postero-anterior and lateral radiographs taken. Cases in which the placental localization was not reasonably certain from these routine radiographs were not included in the series. Table I represents the first 100 cases in which it has proved possible to localize the position of the placenta.

TABLE I
Distribution of Placental Site in 100 Cases of Breech Presentation

Anterior	37
Antero-lateral	7
Posterior	2
Postero-lateral	2
Cornuo-fundal	22
Fundal	4
Antero-fundal	7
Postero-fundal	19
	100

A fundal site is self-explanatory, and a cornuo-fundal site implies that the greatest thickness of the placenta overlies one or other uterine cornu. It must be remembered that the placenta is a comparatively large organ usually occupying one-fifth or more of the decidual surface of the uterus at term. Snow and Powell (1934) state that the placenta occupies about one-third of the wall space of the uterus in late pregnancy. In consequence, it is not unlikely that a part of the placenta abuts on the cornuo-fundal region in a high proportion of cases (Reid, 1951). However, it is only in comparatively few cases that the centre of the placenta overlies this region.

Table II shows the frequency of the various placental sites as noted by a number of independent observers. It is seen that implantation is usually on the anterior or posterior wall, at any rate when the vertex presents, and this is independent of upper or lower segment implantation. As observed by Reid (1951), it frequently extends on to the lateral uterine wall.

Stevenson (1950) has claimed that a cornuo-fundal implantation of the placenta is the principal cause of breech presentation in single term pregnancies. Whitehead (1953) analyzed the position of the foetus in relation to placental site, and found that in association with breech presentations the placenta is more often found to cover one cornu of the uterus than is found with presentations other than breech. He also suggested that cornual implantation favoured persistence of the breech presentation.

As previously mentioned, placenta praevia has long been accepted as one of the aetiological factors in the causation of malpresentation including breech, but in the 100 cases here reported there was no single instance of definite placenta praevia, although, as will be remarked on later, in some cases a minor degree of placenta praevia may have been present—but since the lower edge of the placenta could not be seen with certainty a radiological diagnosis of placenta praevia was not justified. It is, therefore, suggested that whereas placenta praevia and breech presentation can co-exist, their co-existence is uncommon and placenta praevia is a rare cause of breech presentation.

In discussion, Dr. Rohan Williams has stressed the probability that in many unsuspected cases a slight degree of placental encroachment on to the lower segment is present. In a number of cases the placenta is noted to be "low-dipping" and probably corresponds to a Type I placenta praevia (Browne, 1944) without there being any

physical signs to suggest the diagnosis. The diagnosis is a radiological one and depends upon siting the lower edge of the placenta dipping down into the lower uterine segment or visualizing a placenta mostly situated in the upper segment, the lower edge of which is difficult to determine but which, in all probability, is encroaching on the lower segment as judged by the level of its upper limit.

The main difficulty from the radiologist's viewpoint is to determine the level of the junction between the upper and lower uterine segments. Marshall (1939) suggests the junction at term approximately corresponds to the pelvic brim.

The accuracy of soft tissue placentography is undoubtedly high, and, in those cases where a prediction is reasonable, it is nearly always correct. Dippel and Brown (1940) were able to visualize the placenta in 90 per cent of 262 observations.

It is difficult to devise a method of checking the accuracy of prediction, and the two methods usually adopted both fail in some measure for the same reason. Intra-uterine palpation at the conclusion of the second stage of labour or inspection following extraction of the baby at Caesarean section both suffer from the fact that the uterus has already retracted down, and, in any case, it is always difficult clinically to determine the dividing line between the upper and lower segments. There is seldom difficulty in recognizing the major degrees of placenta praevia, but it is in those cases of placenta praevia of minor degree that radiological prediction is uncertain and clinical checking most difficult. Amniography provides another means of checking, but such an investigation is at present here reserved for a few particular cases presenting special indications, and, in consequence, has seldom been available for checking the prediction of placental position made by the soft tissue technique.

The clinical diagnosis of placenta praevia is made by passing the finger through the cervix and feeling the placenta in the lower segment. This procedure may fail in cases of minor degree of placenta praevia since the lower edge of the placenta may be out of reach of the examining finger (Weinberg, 1955).

Reid (1949) placed metal clips on the anterior and posterior lips of the cervix, and in some instances found the promontory of the sacrum up to 10 cm. away from the external os and the mean figure 7·1 cm. A low-dipping placenta might, therefore, be 10 cm. away from the examining finger yet still encroach on the lower uterine segment.

Tables II and III show the higher incidence of cornual and fundal implantations when the breech presents (Table III), as compared with the incidence of such implantations in all presentations (Table II). Stevenson found a cornuo-fundal implantation in every case of breech presentation, and this led to his hypothesis that persistent breech presentation is more likely to occur when the placenta covers a cornu of the uterus.

Table IV shows that in the series reported by Whitehead (1953), out of 179 cases where the subsequent history was known, 86 were delivered by the breech. The placenta was cornuo-fundal in position in 77 per cent of these cases of persistent breech presentation. In the Queen

TABLE II

Frequency of the Various Placental Sites in the Upper Segment

Author	Total	Anterior Per cent	Posterior Per cent	Lateral Per cent	Fundal and Cornual Per cent
Dippel and Brown (1940)	236	43	45	—	—
Torpin and Holmes (1943)	363	45	55	—	—
Reid (1951)	487	44	46	—	3
Stevenson (1949)	474	43·8	31·6	9·7	7·4
Whitehead (1953)	500	35·4	29·2	2·2	25·2

TABLE III
Frequency of the Various Placental Sites in Breech Presentation

Author	Total	Anterior Per cent	Posterior Per cent	Antero-lateral, Postero-lateral, Lateral Per cent	Antero-fundal, Postero-fundal, Fundal and Cornual Per cent	Praevia Per cent
Stevenson (1951)	76	—	—	—	100	—
Whitehead (1953)	187	23	14	2	59	2
Q.C.H. (1955)	100	37	2	9	52	—

TABLE IV
Placental Site in Cases of Persistent Breech Presentation

Author	Cornual	Fundal	Anterior	Posterior	Lateral	Praevia	Total
Whitehead (1953)	60	6	12	4	1	3	86
Q.C.H. (1955)	2	5	4	1	—	—	12

Charlotte's Hospital series, version with or without anaesthesia was successful in 88 per cent, and in the remaining 12 per cent the placenta was cornuo-fundal in position in only a little more than half.

Placental position seems to have little influence on attempted version. It might be thought that, when the placenta is situated anteriorly or laterally, external version would be both more difficult and more hazardous. More difficult because of the extra thickness of tissue through which it is necessary to work, and more hazardous because of the increased likelihood of partial placental detachment when the placenta lies directly beneath the fingers of the operator. Tables I, IV and V show that the incidence of an anteriorly or laterally placed placenta is no higher in those cases where version without anaesthesia fails (40 per cent—see Table V), or in those cases where version with anaesthesia fails (33 per cent—see Table IV) than in all cases of breech presentation occurring after the thirty-second week (44 per cent—see Table I).

The number of cases of haemorrhage following version (Table VI) is happily too small for any conclusion to be drawn. The hazard of bleeding following version is, I feel sure, related to the amount of force employed, and is, therefore, dependent more upon the operator than upon the position of the placenta.

In conclusion, I would suggest that the causation of persistent breech presentation in late pregnancy is still undetermined. Probably a number of different aetiological factors are responsible, and, just as it has come to be realized that placenta praevia is an uncommon cause of breech presentation, so, I believe, cornuo-fundal implantation is not the principal cause though this latter site of implantation would seem to be present significantly more frequently in association with breech presentation, as compared with its incidence in all foetal presentations. Stevenson found a cornuo-fundal

TABLE V
Position of the Placenta in Cases in Which Version Without Anaesthesia Failed

Anterior	Posterior	Antero-lateral and Postero-lateral	Cornuo-fundal	Antero-fundal	Postero-fundal
13	3	—	8	4	8

TABLE VI
Position of the Placenta in Those Cases in Which Ante-partum Haemorrhage Occurred Following Attempted Version

Anterior	Antero-fundal	Postero-fundal
4	1	1

implantation in every instance of 76 cases of breech presentation at or near term, but it only occurred in 22 per cent of our cases.

Before external cephalic version under anaesthesia is attempted, a radiograph should be taken to confirm the foetal presentation and position, and an attempt made to localize the placenta at the same time. External version is contra-indicated if a major degree of placenta praevia is present, but a placenta situated on the anterior or lateral wall of the upper segment of the uterus or cornuo-fundal in position is no contra-indication to version. Being aware of the position of the placenta in those cases where the placenta is close under the fingers, the operator is likely to be on guard during the manipulation, and, in some cases, it may be possible to avoid the area of placental attachment altogether.

ADDENDUM

A new approach to determine the site of placental implantation is now being made, and it is hoped this will provide a method of checking radiological predictions made by the soft tissue technique. It is also possible at the same time to assess the internal surface area of the uterus which had been occupied by the placenta.

Immediately after expulsion, the placenta, with membranes attached, is placed in a tank, and the tank is slowly filled with water, while, at the same time, the hole in the membranes is carefully held uppermost and water from a jug is poured slowly into the amniotic sac. The levels of water inside and outside the sac are kept approximately equal. By this means the amniotic sac is distended until it comes to assume the approximate size and shape it assumed when it was within the uterus. This technique was described by Torpin (1955).

By marking one aspect of the membranes with a dye, such as Bonney's Blue, during delivery, it becomes possible to orientate them subsequently, and so recognize the anterior and posterior aspects. The position of placental implantation can then be deduced, depending on whether it is situated on the anterior, posterior, or lateral aspect of the distended sac, or whether cornual or fundal in position. However, it is still impossible to determine whether a minor degree of placenta praevia existed, unless one arbitrarily assumes that the junction of upper and lower segments is at some definite distance from the internal os.

It has only been possible to try this technique on a few cases to date, but the results are encouraging, and it is intended to continue this work in the future.

SUMMARY

(1) An enquiry has been made into the effect of certain placental implantation sites in causing persistence of breech presentations in late pregnancy and the effect on external cephalic version.

(2) The position of the placenta has been noted in 100 cases of breech presentation and these cases have been analyzed.

(3) Cornuo-fundal implantation has been found more frequently in association with breech presentations than with other presentations but does not appear to be the principal cause of breech presentation.

(4) The position of the placenta has little effect on external cephalic version, but in view of the risk of accidental ante-partum haemorrhage associated with this manœuvre it is suggested that it is of value to know the position of the placenta before version is attempted. A placenta situated wholly or partly to the front of the uterus should excite extra care on the part of the operator.

I wish to record my thanks to Dr. Rohan Williams and his Staff in the Radiology Department without whose help and assistance this investigation could not have been undertaken.

I also wish to thank the Medical Committee of Queen Charlotte's Maternity Hospital for permission to publish this material.

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ROYAL COLLEGE OF OBSTETRICIANS AND GYNAECOLOGISTS

AT the Meeting of Council held in the College House on Friday, 28th September, 1956 with the President, Mr. Charles D. Read, in the Chair, the following were admitted to the **Honorary Fellowship of the College:**

The Rt. Hon. The Viscount Nuffield, *G.B.E.*, F.R.S., F.R.C.S., M.A.
Lieut.-General The Lord Weeks, *K.C.B.*, *C.B.E.*, *D.S.O.*, *M.C.*, *T.D.*, Hon. LL.D.

The following were admitted to the **Membership:**

Leslie Allan Allen.
Arthur Bates.
Robert Gibb Blair.
Gordon Lionel Bourne.
Nancy Isobel Cardno.
Emanuel Cassar.
William Chanen.
Philip Arnold Deck.
Jan Naudé de Villiers.
Meenakshi Ghosh.
John Paul Hendrickse.
Bryan Montague Hibbard.
David Howell.
Ralph Allan St. Clair Hoyte.
Elsie Sachie Jaikaran.
Paul Johannes Joubert.
Alexander Malcolm Kelso.
Andrew William Laughland.
David William Leslie.
Cecilia Margaret Liggins.
Graham Collingwood Liggins.
Eric Macdonald Little.
John Duncan Ott Loudon.
Peter Cornelius McAuliffe.
Clara Jean McFarlane.
Marion Conway Miller.
Sachindranath Nan.
William Joseph O'Sullivan.
Sidney William Fitz-Patrick Page.
John Kenneth Percival Perera.
Shephalika Prodhan.
Nils Albert Regan.
Kathleen Joy Rennie.
Philip Rhodes.
David William Taylor Roberts.
Ian Douglas Ronayne.
Arthur Octavius Sankey.
Henri Hugo Albert Sauer.
Teddy Schneider.
John Stark Skipper.
Thomas Scott Train.
Norman William Ferguson Weir.
Anthony John Woolf.
Janet White Worling.

ETHICON TRAVELLING SCHOLARSHIPS

THE two Ethicon Travelling Scholarships for Theatre Sisters during 1956 have been awarded to Miss A. M. Pollock, R.G.N., Theatre Supervisor, Southern General Hospital, Glasgow, and Miss M. A. Seely, S.R.N., Departmental Theatre Sister, Northampton General Hospital, Northampton.

INTERNATIONAL ABSTRACTS OF BIOLOGICAL SCIENCES

Honorary Editor: C. C. N. VASS, M.Sc., Ph.D., M.B., Ch.B.

THE Council of Biological and Medical Abstracts Ltd. have decided to change the title of their journal *British Abstracts of Medical Sciences* to *International Abstracts of Biological Sciences.*

International Abstracts of Biological Sciences abstracts the world literature in the following fields: Anatomy, Animal Behaviour, Biochemistry, Biophysics, Cytology, Embryology, Endocrinology, Epidemiology, Experimental Biology, Genetics, Haematology, Histochemistry, Histology, Immunology, Microbiology, Nutrition, Odontology, Parasitology, Pathology, Pharmacology, Physical Anthropology, Physiology, Radiation Effects, Toxicology and Viruses.

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REPORTS OF SOCIETIES

EAST ANGLIAN GYNAECOLOGICAL AND OBSTETRIC SOCIETY

March 1956

The first Clinical Meeting was held at the Norfolk and Norwich Hospital on Saturday, 17th March, 1956 at the invitation of our Norwich members. The President, Mr. M. W. B. Bulman, was in the Chair.

Acute Puerperal Inversion of the Uterus

Mrs. A. E. Townsley reported her recent experience with two cases of puerperal inversion of the uterus.

The first case was a domiciliary call. The patient was in extremis and died whilst the blood transfusion was being given.

The second patient was in hospital. A 19-year-old primigravida had a normal vertex delivery, and soon after the birth of the child a complete inversion of the uterus occurred. The placenta remained attached to the fundus. There was little blood loss, but severe shock rapidly developed. No morphia was given, but a blood transfusion was started. Then the placenta was peeled off, the uterus pushed back into the vagina, and an attempt at correction of the inversion made by O'Sullivan's hydraulic method. Difficulty was at once encountered in occluding the vulval orifice, but this was eventually achieved by the use of several vulval pads. The inversion disappeared with a sucking noise taking with it one of the vulval pads, which had to be manually removed from the uterine cavity.

The patient collapsed on two or more occasions during the next two days. Her haemoglobin was 30 per cent and surgical emphysema was noted in the lateral vaginal fornices. There was slight fever for the first week, but she was afebrile during the remaining 14-days stay in hospital. No abnormalities were detected at her postnatal examination.

Discussion

Mr. Bulman opened the discussion. He pointed out that, if morphia is to be given in cases of shock, it should be administered intravenously. The hydraulic method of correcting an acute inversion of the uterus entailed the risk of air embolism and possibly accounted for the recurrent collapses in Mrs. Townsley's case.

Mr. F. R. Stansfield reported three cases successfully treated. He was of the opinion that acute inversion of the uterus was due to fundal attachment of the placenta. After controlling the shock, he preferred to peel off the placenta and reduce the inversion by the hydraulic method. It was essential to use nothing but sterile normal saline, as antiseptic solutions or pure water were both dangerous. He had no difficulty in occluding the vaginal orifice by approximating the labia majora with Lane's tissue forceps.

Mr. A. P. Bentall reported a case of subacute inversion of the uterus that he failed to reduce after trial of both manual and hydraulic reposition. The patient was admitted to hospital, and a laparotomy performed. Traction with Alliss's forceps readily reduced the inversion. (Irving and Foster's method.)

Mr. J. S. Hesketh reported one case. There was no shock, but he experienced difficulty in occluding the vaginal introitus when using the hydraulic method of reposition.

Mr. W. H. Carlisle had encountered one case which he dealt with successfully by a manual reposition. At a subsequent labour this patient ruptured her uterus, and he performed a hysterectomy.

Mr. Mackenzie wondered if the administration of ergot was responsible for the inversions, but our limited experiences did not support this view.

Mr. N. K. B. Kimbell reported his experience with 2 cases of acute puerperal inversion of the uterus. In both cases the placenta was attached to the fundus and neither patient was in shock. One inversion was reduced manually and the other by the hydraulic method.

The President summed up the discussion and commented on the varying degrees of shock that had been encountered. It might be that the shock was due to excessive blood loss.

Intra-gastric Oxygen in the Treatment of Severe Asphyxia Neonatorum

Mrs. A. E. Townsley described a case of severe asphyxia neonatorum treated successfully with intra-gastric oxygen. The baby was the first child of a young mother of 18 years of age, and was delivered easily by the breech. At the time of delivery it was noted that the cord was not pulsating and that it was flat and shrunken. The placenta came out with the baby's head without any noteworthy blood loss. The baby's heart was beating feebly at 30 beats per minute, but there was no attempt to breathe. Intra-gastric oxygen was administered through a double channel catheter with a water valve. After 20 minutes the infant gave a feeble cry, and after 25 minutes it cried lustily. Subsequently the infant progressed well on breast feeding. There was no evidence of any cerebral damage.

Discussion

There was general agreement on the use of intra-gastric oxygen. Mention was made of the availability of the Sparklet oxygen equipment for domiciliary use. There was a diversity of opinion as to the advisability of warming these babies up.

Carcinoma of the Vulva

Mr. A. P. Bentall reported a series of 91 cases of carcinoma of the vulva treated at the Norfolk and Norwich Hospital in the past 10 years. Some of the cases had been treated by the general surgeons, and the methods of treatment were diverse, ranging from radium and deep X-ray therapy to a variety of forms of surgical attack including the radical excision popularized by Mr. Stanley Way.

Results

Forty-one cases were treated up to 1950—10 survive.

Mr. Stanley Way reports an absolute survival rate of 61 per cent with a 12 per cent operative mortality.

Mr. Bentall's Series:		Per cent
Total cases	27	
Operative mortality ..	1	4
5-year survival rate	5 out of 11	45
5-year survival rate (radical surgery)	4 out of 7	57
3-year survival rate	8 out of 19	42
3-year survival rate (radical surgery)	7 out of 12	58

Mr. Bentall emphasized that carcinoma of the vulva tended to be a disease of elderly women whose life expectancy was short, and that there was therefore a place for local excision in the treatment.

Local Excision. Ten cases all over 70 years. Five cases have survived for 1–4 years.

Re-excision. This has been successfully performed on 2 cases. Primary healing of the wounds only occurred in half the cases. In those wounds that broke down he had followed the President's suggestion of applying pure honey to the wounds with gratifying results.

Discussion

The President stressed the difficulty in assessing the prognosis for any individual case when there were so many factors to be considered; the age of the patient, the duration of the disease when the patient is first seen, and the site of the growth. He thought there was a place for simple vulvectomy in the treatment of the elderly patient. When he performed a radical operation, he called the plastic surgeon to his assistance so that an immediate skin graft of the raw surfaces could be carried out.

Mr. Stansfield was of the opinion that carcinoma of the vulva was commoner in East Anglia than elsewhere in the country. Whillis estimated the incidence as 1 case of carcinoma of the vulva, to every 25 of carcinoma of the cervix. He thought it would be useful to embark on a group study of carcinoma of the vulva in East Anglia.

Miss J. E. Bottomley had seen a case of carcinoma of the vulva recently in which the original growth had been excised in 1938. She wondered whether this was a recurrence or a new primary growth.

Mr. Harrison reported one case which he had treated by repeated local excision of the growth. He found the "honey treatment" of great value.

The President warned that the honey should be unadulterated and not heat-treated. The honey dressing was changed every 24 hours.

Mr. Kimbell was convinced that in many cases of carcinoma of the vulva the growth was multicentric.

Mr. Mackenzie found that skin grafting, both immediate and delayed had proved a failure. He was troubled by the restriction of hip movement that occurred 4 to 5 years after a radical vulvectomy.

Mr. Bentall commented on the late post-operative problem of oedema of the lower extremities.

The Sharman Curette

The President, Mr. Bulman, described his technique for the use of this instrument in the diagnosis of abnormalities of the endometrium and presented five microscope slides of material obtained by this method showing:

1. Adenocarcinoma.
2. Hyperplasia of the endometrium.
3. Secretory endometrium.
4. Early interval endometrium.
5. Post-menopausal endometrium.

The use of this instrument allows of a speedy diagnosis in a majority of cases without admitting the patient to hospital for a curettage—an important consideration in these days.

Admission to hospital for diagnostic curetting under anaesthesia is now reserved for cases in which the Sharman curette cannot be used or in which treatment of bleeding in the Out-Patient Department (including the use of X-ray menopause) has failed to relieve symptoms. Apart from unmarried women and those past the menopause in whom it is usually impossible to use a Sharman curette the number of known cases in which this method of diagnosis has failed is extremely small.

Discussion

Most of the members were dubious about this use of the Sharman curette as they feared that they might overlook polyps, tuberculosis of the endometrium or even adenocarcinoma of the body of the uterus.

Mr. Mackenzie supported the President's contention, and thought that in the hands of an expert it would be safe. He hoped the President would report a series of cases investigated by the use of the Sharman curette.

NORTH OF ENGLAND OBSTETRICAL AND GYNAECOLOGICAL SOCIETY

April 1956

A Meeting of the North of England Obstetrical and Gynaecological Society was held at Leeds on Friday, 20th April, 1956. The President, Mr. C. H. Walsh, was in the Chair.

Dr. M. R. Webster reported a case of

Removal of a Granulosa Cell Tumour of the Ovary Followed by Full-term Pregnancy

The patient, aged 26, was first seen in 1951, owing to increasingly heavy and prolonged menstruation. She

appeared well, nothing abnormal was found on abdominal examination, but *per vaginam* a firm mass, 2 inches in diameter, could be felt in the right fornix. At laparotomy, the uterus was seen to be slightly enlarged, the left ovary was essentially normal, a solid tumour was found in the right ovary, and a right salpingo-oöphorectomy was done. The tumour proved to be a granulosa cell tumour of the finely follicular type and luteinization of many of the cells was seen.

Later, the patient married, and after an uneventful pregnancy was delivered in 1954 of a healthy child. When seen a month ago she was still lactating and menstruation had not yet recommenced.

This case is of interest as a granulosa cell tumour is more commonly found in the post-menopausal years, and the infertility rate is high. Dr. Webster then discussed the types of granulosa cell tumour and the aetiology. Treatment depended to some extent on the age of the patient, and because these tumours are potentially malignant, a careful check must be kept for some years.

Discussion

The President thought that after removal of the tumour there was no reason to postulate impaired fertility.

Mr. R. W. Burslem had surveyed all cases of granulosa cell tumour over a 30-year period in one hospital. Three had become pregnant, and one patient died of a recurrence 8 years later. The tumour occurred as frequently before as after the menopause.

Dr. H. A. Kelsey discussed

Abdominal Manipulation in Face Presentation

Face and brow presentations are not common conditions, and we are bound to rely on teaching from our seniors and textbooks, yet most books are unanimous in waiting for the spontaneous onset of labour without interference unless the pelvis is contracted or the chin posterior. In a recent case, however, this line of treatment had resulted in partial flexion and obstruction with the brow presenting.

Schatz's manœuvre is usually regarded as difficult and commonly unsuccessful; moreover F. J. Browne states that it can be done only if the chin is anterior. Recently 2 cases had been treated successfully and 1 case failed. The first case was a gravida-3, aged 37 years, and uncertain of her dates. About the 28th week of pregnancy hydramnios was found, and 6 weeks later she was admitted to hospital for rest. Paracentesis afforded relief and X-ray showed a mature foetus with the face presenting and chin posterior. Schatz's manœuvre was performed by Mr. Theobald, and on X-ray a vertex presentation was found. After rupture of the membranes, the child was delivered *per vaginam* and weighed 9 pounds.

The second patient, a gravida-3, aged 24 years, was admitted at the 42nd week on account of postmaturity. A face presentation was found and was corrected by Schatz's manœuvre, after which the membranes were ruptured. Spontaneous delivery of a baby weighing 9 pounds 9 ounces took place.

In the third case correction of the presentation failed. The patient was a gravida-9, aged 43 years, and she was admitted at the 34th week of pregnancy because of hypertension. An X-ray was taken, but the films were held up for a few days, so that an external version was performed before they were seen. It was then found that before version the foetal neck was extended, with the foetus in the "star gazing" position. A further film now showed the baby still in this extended attitude. Schatz's manœuvre was attempted next day, but in this interval the foetal back had rotated to the opposite side, and this produced an error which caused failure of the manœuvre, and the brow now presented. Labour commenced and with the aid of Willett's forceps the child was delivered spontaneously, the vertex presenting.

From these facts it is shown that manipulation should be undertaken at once when a face or brow presentation is found near term.

Discussion

The President asked if any reason had been found for the face presentation. He pointed out that flexion may occur without manœuvres, and that the star gazing foetus is better left with the breech presenting.

Professor S. C. Russell commented on many cases of face presentation being unstable.

Dr. R. Newton could not agree with all that had been said and he had very rarely found a valid reason for face presentation.

Dr. W. Hunter supported Dr. Kelsey, and thought the optimum time for the manœuvre was early labour. He advocated correction of brow presentations before moulding has occurred.

Mr. T. B. Fitzgerald mentioned two types of brow or face presentation. In one extension is a passive phenomenon and the attitude can be corrected, but in the other there is spasm in the extensor muscles and the attitude is relatively stable and cannot be corrected.

Mr. T. Redman thought that when the presentation might vary, correction of a face presentation should be left to early labour.

Dr. C. Curtis Bain and Mr. C. Rutherford Morison presented

An Unusual Case of Hypertension in Pregnancy Treated with Hypotensive Drugs

Because of the ease of administration and control of Ansolysin and Rauwiloid there would be advantages in treating certain types of pregnancy toxaemia with these drugs, and the following case illustrated their use.

In 1948 in the first pregnancy the patient developed hypertension and albuminuria, and the foetus died *in utero*. Later the blood pressure returned to normal, but in 1951, when the patient again became pregnant, the hypertension and albuminuria reappeared and the foetus died at the 29th week. Between the second pregnancy and the third the blood pressure was normal, but

marked anaemia was found. The patient did not come for examination until the 20th week of her third pregnancy when her blood pressure was found to be 180/110 and this was controlled with Ansolysin and Rauwiloid after careful investigation. In this way symptoms were controlled until the 33rd week of pregnancy when there was gradual deterioration until 3 weeks later. Following a single eclamptic fit, the foetal heart became erratic, and Caesarean section was done at once in order to secure a live child.

Dr. Bain outlined his treatment of this patient and other cases showing pre-eclamptic toxaemia with Ansolysin and Rauwiloid.

Discussion

The President was intrigued by the aetiology in these cases and was especially concerned with the type of case that remained well until the 28th week when signs of pre-eclamptic toxaemia develop rapidly with death of the child. He had found hypotensive drugs more useful in cases of essential hypertension.

Mr. T. Redman had recently looked after a patient with essential hypertension whose blood pressure was very labile. Hypotensive drugs were used, but despite this the baby died at the 29th week of pregnancy and thereafter the blood pressure fell.

Miss C. Bates recorded the case of a patient with true hypertension. At 2 months the systolic blood pressure was 200 mm. Hg. The baby grew slowly but died *in utero* at the 33rd week, and the placenta was small. Despite large doses of hypotensive drugs and rest throughout, the systolic blood pressure never fell below 160 mm. Hg.

In his reply Mr. Rutherford Morison thought hypotensive drugs should be given a trial, and the blood pressure could be reduced by their use.

Dr. K. V. Bailey read the second part of his paper entitled

UTERINE PROLAPSE WITH STRESS INCONTINENCE

(This article appears on page 663 of this issue)

Discussion

The President thought that many operations were done without sufficient attention being paid to the stress incontinence and the selection for the type of operation.

Dr. R. Newton thanked Dr. Bailey for the enormous amount of work that was involved.

Mr. T. B. Fitzgerald commented favourably on the modified colporrhaphy operation.

NORTH OF ENGLAND OBSTETRICAL AND GYNAECOLOGICAL SOCIETY

JUNE 1956

A Meeting of the North of England Obstetrical and Gynaecological Society was held in Newcastle on Friday, 1st June, 1956.

Mr. J. K. Russell reported a case of

FOETAL EXSANGUINATION FOLLOWING SURGICAL INDUCTION OF LABOUR

During the past 5 years 9 babies have lost their lives in the hospital because of loss of blood from the foetal circulation at the time of induction of labour. Previously Mr. Russell had reported the hazard of foetal blood loss at the time of Caesarean section for placenta praevia.

In the present case artificial rupture of membranes was undertaken at the 38th week of pregnancy because of hypertension and albuminuria. A few drops of blood stained fluid were obtained by the Drew Smythe catheter, but no placenta could be felt. For the next 24 hours there was persistent staining of blood, and 4 hours later still the foetal heart slowed. Caesarean section was performed and the baby was delivered limp and pale. A small quantity of dark blood came away with the placenta which was thought to be due to accidental haemorrhage, but on closer inspection of the placenta the blood was seen under the membranes on the foetal aspect, and a small puncture was found in one of the foetal vessels.

Despite blood transfusion the baby died.

This case illustrates the need to differentiate foetal from maternal blood, and such a test has been introduced.

Discussion

Mr. T. Redman asked for an outline of the test.

Dr. Anderson described the test he is using which depends on the reaction of foetal blood to alkali. A known amount of alkali is added to a quantity of blood and left for 1 minute. In adult blood there is a colour change from red to sherry, but no change in foetal blood. After filtration, the adult filtrate is colourless and the foetal red or pink. The test is not vitiated by dilution with liquor, and will be positive with as little as 10 per cent foetal blood.

Mr. F. J. Burke read a short paper on

SOME REFERENCES TO PLACENTA PRAEVIA

This paper is mainly concerned with the X-ray diagnosis of placenta praevia and its importance is the only justification for raising the subject again.

Placenta praevia responds well to treatment if recognized in time and undoubtedly improvements in the methods of diagnosis are the key to better results. Radiology is the most promising means to this end, but after 25 years it is still in the experimental stage, and so far no one method satisfies all requirements. There is also diversity of opinion among obstetricians and radiologists on the best methods, and the extent to which radiology is employed varies considerably in different clinics.

It is clearly outside the scope of a short paper to include all methods of placental location and only brief reference will be made to most of them. Cystography falls into this category. It is safe to say that it provides little reliable information and none at all in posterior placenta praevia. Its main use appears to be in conjunction with other methods. Retrograde femoral arteriography and

aortography will demonstrate a low lying placenta, but because of the obvious risk neither is likely to achieve much clinical significance. Isotopes have also been employed but for reasons which will appear later it is doubtful if they can be of much help.

Soft Tissue Radiography

The method most widely used is soft tissue radiography, and it is frequently stated that placental location is successful in over 90 per cent of cases. Considerable technical improvements have been made during the past 20 years, but everybody would not agree that the method is 90 per cent accurate. It should be borne in mind that putting a hand inside the uterus at Caesarean section or after vaginal delivery as a check on the X-ray diagnosis is often misleading and it may be difficult to imagine the exact position the placenta occupied in the fully distended uterus. One writer claims 100 per cent accuracy in routine examinations even though no actual confirmation of diagnosis was done in 70 per cent of his patients. Surely to establish such a claim every case must be proved and if failure to diagnose placenta praevia is the only criterion of error, then a high level of success is assured, as the incidence of placenta praevia is normally 1 in 200 pregnancies. It is frequently stated by soft tissue radiologists that the placenta is usually found with equal frequency on the anterior and posterior walls and very rarely on the lateral walls. One observer, who concedes nothing in accuracy to his colleagues, states that it is almost invariably obliquely or laterally placed and is rarely found on the anterior or posterior walls. In making these observations it is not my intention to defame soft tissue radiography, and it is important if the placenta can be found in the upper segment, as is usual in 88 per cent of cases of ante-partum bleeding. The positive recognition of the placenta in the upper segment is the most valuable contribution of soft tissue radiography, but it is less successful in cases of placenta praevia, where visualization of the placenta may be difficult owing to the bony background. Displacement of the presenting part cannot be taken as proof, and the head may even be deeply engaged. More important than this is the difficulty in defining the lower edge of the placenta, and because of these difficulties 12·9 per cent of cases in one series could not be confirmed clinically.

Amniography

A clearer method of placental location is amniography. Results are particularly good in cases of placenta praevia. The placenta can be seen in the pelvis, and the lower edge defined. In a series of cases published in 1935 there was no instance of maternal injury, and there was only 1 unexplained stillbirth, a rate of less than 1 per cent. In a series published by Playfair the unexplained stillbirth rate was 3·6 per cent, but in the control series of induction of labour by rupture of membranes there was an unexplained stillbirth rate of 4 per cent.

If soft tissue radiography supports the diagnosis of placenta praevia, but fails to demarcate the lowest edge, this should be done either by vaginal examination or by amniography. In no case should Caesarean section be undertaken for suspected placenta praevia without full preliminary investigations.

Discussion

The President asked if a radiologist was present. He also commented on the difficulty of establishing the placental site at Caesarean section once the baby is delivered. He could not be satisfied that repeated X-rays were without harm.

Mr. W. Hunter enquired in what proportion of cases labour was started.

Miss M. Goldston asked at what stage of pregnancy should amniography be performed.

Mr. J. K. Russell said that in his unit soft tissue radiography had been satisfactory, and he was not sure if amniography could give further help.

Mr. F. Stabler thought it would be dangerous to rely on X-rays, and these methods should not replace vaginal examination. He recounted the case of a placenta in the upper segment, and a succenturiate lobe in front of the presenting part.

In his reply Mr. Burke said that the results of soft tissue radiology were not good. He used Uroselectan as the contrast medium, up to 6 plates were required, and he was unable to answer the question of ill effects on the child. Labour might be induced and examination was therefore left until after the 36th week. Though he did not abandon vaginal examination, a fatality from this had discouraged him.

Miss Una Lister read a paper on

OBSTRUCTED LABOUR IN SOUTHERN NIGERIAN WOMEN

This subject was chosen because with its sequelae of ruptured uterus and vesico-vaginal fistulae, it forms the greatest problem, and accounts for the largest number of maternal deaths. The paper is a review of the cases seen during the last 2¾ years in a hospital in Ibadan in Western Nigeria.

Ibadan lies about 7 degrees north of the equator just within the humid coastal forest belt. The tsetse fly prevents cattle from being kept in any numbers—meat is expensive and milk unobtainable, so that the diet of the average patient is grossly deficient in protein. The people are traders and farmers, and apart from bread they grow their own foodstuffs—yams, cassava, peppers, palm oil, groundnuts and fruit. Tropical diseases are rife; malaria and dysentery are universal, yaws, tetanus, amoebiasis, and many others are commonplace, about 95 per cent of the population have intestinal parasites, and the mortality among children up to the age of 5 years is nearly 60 per cent.

Adeoyo Hospital is a small Native Administration hospital enlarged by constant additions to bring it up to a reasonable standard. The obstetric wards contain 46 beds, obviously inadequate for a town of half a million people—the size of Leeds. As the majority of houses are mud brick without water or sanitation, and infested with goats, jumbled together without proper roads, domiciliary midwifery presents such a problem that it has not been attempted. The number of women demanding

hospital confinement increased by almost 1,000 from 1954 to 1955, straining inadequate hospital facilities.

So far no patient has been refused. The majority are from Ibadan, but emergencies come long distances, as for example the woman who delivered the head at home, but the shoulders remained impacted. She walked 10 miles to the road, and was brought 18 miles by lorry to hospital where she was delivered after cleidotomy. One peculiarity of the hospital, common in Nigeria, is that the patients are not fed by the hospital except for supplementary diets, and often completely unsuitable food is brought by the relatives.

During the last 2¾ years, in about 10,000 deliveries, there were 247 cases classed as obstructed labour, 80 among booked and 167 among emergency patients. It is not always easy to decide what cases should be included in this category. Many are obvious, for example, impacted transverse lies, locked twins and hydrocephalus admitted in labour. Only cases of high forceps have been included, though the fully developed picture of obstructed labour is not always found.

The pregnancy and labour of women in southern Nigeria differ in several respects from those seen in England. In neither primigravidae nor multigravidae does the head engage as a rule until late in labour, and it is more difficult to forecast the course of labour than here. The Nigerian woman's pelvis is shallow, and though figures are not available, it seems smaller with a steep brim inclination.

Labour tends to be short, and even in primigravidae a 10 to 20 minute second stage is normal. There are many unexplained stillbirths where the foetal heart is said to be good, but a few minutes later the baby is born dead. From a few post-mortem examinations, gross cerebral damage is rare, and signs of asphyxia only are found.

Except in the more sophisticated and educated women such as school teachers and nurses, a slow labour due to psychological causes is almost unknown. A slow labour in an illiterate woman is due as a rule to some degree of disproportion, so that anyone who has laboured for 24 hours must be very carefully assessed. Rupture of the membranes occurs generally at full dilatation of the cervix, but in a very long labour the membranes rarely remain intact throughout the first stage. As the patients become infected with a rapidity and severity rarely seen in non-tropical countries, the presence of ruptured membranes may influence the obstetrician to earlier intervention.

A typical case history of obstructed labour is as follows. The patient may have delivered normally one or two living children. There is a high incidence of prematurity due to twins, malaria and malnutrition, and it is generally impossible to obtain an accurate estimation of the birth weights. These women's ideas of times and facts are vague in the extreme, their ages are usually unknown, and details of their children and labours are unreliable. Often a stillbirth is omitted from the obstetric history, as for example one patient who posed as a para-2 at the age of 45; as the first 18 children were either stillborn or died before 6 months, she had not thought to mention them. With increasing foetal size and an occipito-posterior position, labour obstructs. Often the woman is not brought in until one of the following has occurred: (1) the husband may be out at work or on a journey, and the woman may not be brought in until he has returned and given his consent; (2) all methods of treatment at home have failed; or (3) the woman is *in extremis*. As a rule women delivering outside bear down as soon as the membranes rupture, often in a squatting position, which must be exhausting, and various degrees of paresis of the sciatic nerve are frequent. Very active measures are instituted if parturition fails to take place soon, but as all hope of delivery at home vanishes, the woman is transported to hospital, sometimes long distances of 20 to 30 miles by lorry.

On admission she presents the typical picture of obstruction, febrile with rapid pulse, low blood pressure, exhausted and dehydrated. The uterus is in tonic contraction, acutely tender, the bladder distended, and the foetus dead with the caput showing at the oedematous vulva, though the greatest diameter of the head is still above the brim. It is often impossible to tell if the uterus is ruptured, especially with a posterior tear and the foetus still *in utero*. As the average woman is grossly anaemic, a haemoglobin of 40 per cent may not indicate either blood loss or infection. We have learnt from bitter experience that a craniotomy done in the labour ward and transportation of a shocked unconscious patient to the theatre for repair of a ruptured uterus is attended by so high a maternal death rate, that all doubtful cases are delivered in the theatre.

Not every case of obstructed labour presents this advanced picture. Because of late engagement of the head, many labours are classed as "trial labours", though the women later deliver rapidly. Few elective Caesarean sections are, therefore, done, and this leads to a rather over-confident attitude on the part of the nursing and medical staff. As the head commonly remains high until the second stage, degrees of disproportion are lost on the midwife, and it is possible for signs of obstructed labour to develop without causing alarm, before a reliable medical opinion is obtained. This hopeful attitude is reflected in the patients. A girl of 19, for whom in 1953 a craniotomy was done for advanced obstructed labour and a large ovarian carcinoma removed a few days later, in spite of attending the clinic and being severely warned, came to hospital again with obstructed labour.

Obstruction may develop rapidly. Siwatu Jimo had delivered twice before. She attended the clinic regularly and disproportion became evident, but a short trial of labour was considered. She was admitted in early labour at 6.45 a.m. Owing to the inconvenient time, and in those days the house surgeon was not resident, she was not seen until 8.30 a.m. By then the foetus was dead and the uterus ruptured. After craniotomy the uterine tear was repaired. In a further pregnancy Caesarean section was done for a 6-pound child.

Occasionally tonic contraction develops during the first stage. After 1 to 2 days in labour, the cervix fails to dilate further, the membranes rupture and usually the foetus dies. We are unwilling to perform Caesarean section when the foetus is dead, as the woman dis-

couraged by her unsuccessful hospital delivery is unlikely to appear again.

In conclusion, during a period of 2¼ years, there were 247 cases of obstructed labour with 153 stillbirths among 10,000 deliveries. Rupture of the uterus occurred in 44 cases, and 38 per cent of the maternal deaths were from obstructed labour, the majority being emergency cases. Not only does obstructed labour account for much loss of life, but much permanent disability may result, so that it forms the greatest obstetric problem.

Discussion

The President congratulated Miss Lister on her paper. He thought that to deliver 5,000 patients in a year with 46 beds was phenomenal, and wished to know how soon the patients were discharged. He was interested in the dietary deficiencies, the shallowness of the pelvis and the theatre conditions. He also asked if inversion of the uterus occurred, and what sorts of forceps were employed.

Mr. Linton Snaith thought that the paper was the most interesting one he had heard at a meeting of the North of England Obstetrical and Gynaecological Society. He wondered if we should warn and teach the West African students who came to England for their training regarding the conditions they must meet on their return.

Mr. C. E. B. Rickards commented on the responsibility of the small staff for such a turn-over.

Miss M. Goldston enquired about food deficiencies.

Mr. B. Williams thanked Miss Lister for the paper, and said that the College standard of number of patients per bed per year must be impossible. He asked about the methods of anaesthesia used, what analgesics were employed, what happened in subsequent labours, and what instruments were used for craniotomy.

Mr. T. Redman enquired about the frequency of pre-eclampsia.

Mr. T. Robinson said that this paper was intriguing, and reminded him of the *Birth of Mankind*. Should one do a Caesarean section when the patient was still conscious, or was it less distressing to await unconsciousness.

In her reply Miss Lister answered many points.

(1) House surgeons went round the wards 3 times a day and discharged normal patients who had been delivered more than 4 hours.

(2) No rickets was found, and the shallow pelvis might be a racial characteristic.

(3) Posterior uterine tears were often clean and vertical with the foetus still *in utero*, but as an anterior incision had to be made hysterectomy was essential.

(4) There had been no case of inversion of the uterus.

(5) Until recently the anaesthetist had worked alone. Pentothal was not used in these shocked patients, and now cylinders of oxygen and nitrous oxide were available. Open ether was a common anaesthetic even in country hospitals lit by Tilley lamps.

(6) A second theatre had now been provided. Neville Barnes and Kielland forceps were usually employed. Craniotomy was performed with sharp perforators and about 6 Morris' forceps applied, the skull being collapsed with a rotary movement and traction. Decapitations were done with scissors. The lower segment operation was performed exclusively because of the risk of rupture of the scar if the patient did not return to hospital.

(7) A new hospital is shortly to be opened with 120 obstetric beds. At present a Native Administration hospital is in use and, owing to cost and inadequate kitchens, food is not provided.

(8) It is probably better for the student to get a grounding in good obstetrics, and then to teach the more unusual practices that are necessary to meet the conditions in tropical countries.

(9) Infection is common. Patients with ruptured uteri die on the first day from blood loss and shock, and on the second from infection, but thereafter there is a good chance of survival. Coliform bacilli and streptococci were commonly found in intra-abdominal and uterine swabs, and treatment was on the usual lines, serum for gas gangrene and tetanus also being given.

(10) Few cases of pre-eclampsia were found, but in the period under review 28 to 30 patients were admitted having had fits.

(11) Probably the conditions were comparable with those found in England 100 years ago, but with the modern approach to problems of surgical and medical treatment.

HOSPITAL REPORTS

BY

JOHN S. TOMKINSON, M.B., F.R.C.S., M.R.C.O.G.

CLINICAL REPORT OF THE DEPARTMENT OF OBSTETRICS, UNIVERSITY COLLEGE, IBADAN, NIGERIA, FROM 1ST APRIL, 1953, TO 31ST DECEMBER, 1954

THIS fascinating report represents the "blood and thunder" of obstetric practice that may only be encountered today in a primitive community. We are fortunate that a devoted group of workers, headed by John Lawson and Miss U. G. Lister, found the time and energy to present it. It is full of interest and will be an eye-opener to those who jog along happily in well-equipped hospitals full of enlightened patients (*sic*) and helped by trained assistants. Those who have been favoured by receiving the report are urged to pass it on; the less fortunate should beg, borrow or steal a copy.

The report consists of a Foreword, an Introduction, a Statistical Review, and a Clinical Review followed by tables and a Paediatric report. The Foreword ends by saying that "the plans which were made for the improvement of the Department during the period under review began to come to fruition by the end of it. The results recorded are, I know, by European standards appalling. However, they are presented in such a way as to indicate the ways in which I hope, in future years, they may be improved. The report will be valuable to all who work in the Department in the future, as a baseline to look back on and to leave far behind. I hope it will also be useful to colleagues who work in other backward countries, and perhaps, too, it may be of interest to those in more favourable circumstances. The report describes a period in the Department's existence—the 'End of the Beginning'."

The Introduction gives a Historical Note stating why there is a Department of Obstetrics and University College in Ibadan; then goes on to provide a background of community served, details of the facilities in the Department ("The equipment of the Department, except in obstetric instruments, was on the scantiest scale imaginable in 1953. Everything from scissors and kidney-dishes to linen and bedding was quite inadequate") and of the medical and midwifery staff during the period reviewed. By September, 1953, there was available lying-in accommodation for 45 patients, 2 single-bedded rooms (one for eclamptics), a 6-bedded first stage labour room, and a delivery room of 4 beds; also a 2-bedded septic labour room and a 5-bedded lying-in ward for septic cases. There was no obstetric theatre, and indeed only one theatre for the whole hospital.

With these facilities, the Statistical Summary states that 5,582 patients were delivered in hospital, and of these 1,004 were emergencies. There were 76 maternal deaths (24 booked and 52 emergencies). The stillbirth rate was 40·3 per thousand for booked cases and 207 per thousand for emergencies, a total of 409 stillbirths occurring in the hospital. The neonatal death rate was 49·6 per thousand booked cases and for emergencies 126·5 per thousand, a total of 333.

There follows a Critical Review, preceding the lists of tables as advised by the Royal College of Obstetricians and Gynaecologists. This Review acts as a key to the reading of the tables; it is of absorbing interest and will amply repay a very close study. For here is a modern approach to the problems that occur relatively infrequently in a civilized community and the experiences of a lifetime compressed into a little over a year and a half. As an example, there were 35 cases of ruptured uterus during the 20 months and 49 cases of craniotomy; this kind of material should produce the wanderlust in those anxious to improve their experience in the management of the mechanics of obstetrics and are willing to forego the television.

The authors comment on the tables in turn, stressing differences in clinical practice, the methods adopted at first and then often modified to suit the local conditions. Tropical diseases as malaria, dysentery, bilharzia, and profound anaemia (probably due to dietetic deficiency of protein, for iron deficiency was not prominent), intrapartum and post-partum procidentia were common, and there were 12 cases of vesico-vaginal fistulae from obstructed labour. Some conditions occurred less commonly than in the British Isles, such as pre-eclampsia, eclampsia, and hyperemesis gravidarum.

The treatment of placenta praevia was changed in an interesting manner during the 20 months. At first Caesarean section was freely performed, but gave way (because of the tendency for the patient to avoid hospital delivery in future) in favour of internal version and immediate breech extraction. This was replaced by gentle traction to compress the placental site. The desires of the patient and the demand for beds coincided to shorten the conservative treatment of placenta praevia, but it was found unwise to do this without a preliminary examination under anaesthesia.

A high incidence of multiple pregnancies was found, 1 in every 24 pregnancies, and apparently there is an extensive local mythology concerning twins. The authors hope that the facilities for the care of premature babies will improve so that the high perinatal mortality may be lowered.

Owing to the difficulty of obtaining any details about a patient's previous Caesarean section from another hospital, the management of a case having a previous Caesarean section was usually decided on the clinical findings in the current pregnancy. Of 62 cases, 13 cases had an elective section, 6 were sectioned after a short trial of labour, 39 were delivered successfully *per vaginam*, and 4 were found to have ruptured the scar (2 of these ruptured during labour and were delivered abdominally, and in 2 the rupture was found after vaginal delivery).

Many patients were admitted as emergencies with a retained placenta, shocked by well-meaning efforts to expel the placenta by abdominal pressure. They arrived by lorry or by taxi. "Many patients walked in with the placenta retained, and, since the local custom is to leave the cord undivided until the placenta is delivered, the husband was occasionally to be seen walking behind carrying the baby still attached to its mother by the cord."

The Caesarean section and the forceps delivery rates were low, both being 2·3 per cent of the total deliveries. In both series, inertia was an uncommon cause.

The authors' views on the treatment of rupture of the uterus should be stated in full. "We are of the opinion that the surgical treatment of complete rupture of the uterus should be the minimum operative procedure possible. The quicker and the less traumatic the procedure in these precarious patients the better. At the beginning of the series, with almost no previous experience of this problem, we performed a hysterectomy in almost every case. Later, we began to repair the ruptures with more confidence, with a single continuous catgut suture to secure haemostasis and shut off the peritoneal cavity from the uterine lumen. Our present position is that we perform whichever seems easiest and quickest. Often the uterus was almost completely detached by an extensive tear, in which case hysterectomy was obviously the best treatment. In other cases the rupture was easy to repair." Thirty-five cases occurred, with 15 maternal deaths. They recommend sterilization after repairing a ruptured uterus.

An analysis of the 76 maternal deaths during the period showed that 16 were due to sepsis and anaemia of pregnancy, 15 to ruptured uterus, 9 to post-partum haemorrhage, 3 to placenta praevia, 3 to eclampsia, and 2 to obstetric shock. Noteworthy absentees were rheumatism, heart disease, pulmonary embolism, and anaesthetic deaths.

The Paediatric Report was written by the obstetric authors. Interesting points brought out were that the greatest single causative factor in the total perinatal mortality was prematurity, others being maternal anaemia (acute or chronic), malaria, and disproportion. There was a complete absence of congenital syphilis and erythroblastosis, but they point out that routine post-mortem examinations might show this to be an apparent rather than real absence.

In conclusion, one can only feel full of praise for those who have worked to produce this report. At times they must have thought whether it was worth while. It is.

BOOK REVIEWS

"Die Kolposkopie in der Praxis. Einführung in die gynaekologische Krebsfrühdiagnostik. (Colposcopy in practice. Introduction to the early diagnosis of gynaecological cancer.)" By HERBERT CRAMER. Pp. 103, 40 colourphotographs, 40 diagrams, 40 photomicrographs. 48 refs. Georg Thieme, Stuttgart, 1956. Price DM30.

THIS little book, more an atlas than a textbook, endeavours to introduce gynaecologists and general practitioners to the diagnostic technique of the colposcope. It does so with the aid of excellent coloured reproductions of colposcopic appearances, each of these being explained by black and white diagrams and compared with photomicrographs of a histological section of the same area.

Dr. Cramer is an enthusiastic disciple of colposcopy. He maintains that the colposcopic technique is simple, not more cumbersome than the introduction of a speculum and advocates its routine use in gynaecological examinations. It seems a pity, however, that Dr. Cramer has restricted his book to colposcopy proper and has not taken more recent advances such as colpomicroscopy into consideration.

The theoretical section of Dr. Cramer's book is short and concise. It explains the diagnostic advantages to be gained by the use of colposcopy and gives a brief but detailed description of its technique. The main part of the book deals with colposcopic appearances and their histological background and is richly illustrated by magnificent colour photographs. These illustrations are very impressive and with the aid of diagram and histological section easy to interpret. After studying the book and these photographs one understands Dr. Cramer's enthusiasm for this important addition to the armamentarium of gynaecological diagnosis and feels sorry that this technique has not been more widely adopted outside Germany. *Erica Wachtel*

"Recent Advances in Pharmacology." By J. M. ROBSON, M.D., D.Sc., F.R.S.E., and C. A. KEELE, M.D., F.R.C.P. Second Edition. Pp. xii+501, with 66 illustrations. J. and A. Churchill, London, 1956. Price 40*s*.

WITH rapidly increasing knowledge, the boundaries between the various medical sciences and the different specialities become less well defined, and the common ground becomes ever more extensive. The obstetrician and gynaecologist of today requires a much wider knowledge of allied subjects than did his predecessors. Even so it is astounding how much of the contents of this second edition of *Recent Advances in Pharmacology* is cognate to the practice of obstetrics and gynaecology; more than half of the chapters present subjects or substances of immediate interest and importance. The properties of adrenaline and noradrenaline are discussed together with their bearing on the diagnosis and treatment of phaeochromocytoma. The accounts of the pharmacology of the various hypotensive drugs—ganglion blocking drugs, the alkaloids of veratrum and rauwolfia, and hydralazine—and of their clinical value singly or in combination are important to those who must manage the toxaemias of pregnancy. There are chapters on chlorpromazine and anti-emetic drugs, on the newer antibiotics and on the anticoagulants and, of particular value, there is a clear account of recent work on the adreno-hypophyseal system.

The authors and publishers are to be congratulated on producing another up-to-date, well-balanced and reasonably priced volume of the famous "Recent Advances" series.

"Psychosomatic Aspects of Surgery." Edited by A. J. CANTOR, M.D., and A. N. FOXE, M.D. Pp. xii+220. Grune and Stratton, New York and London, 1956. Price $6.50.

THIS book comprises the major papers presented at a conference of the Academy of Psychosomatic Medicine held in New York in 1954. The object of the conference was to offer to the surgeon the basic principles of functional and organic disorders as they relate to the emotions. And who could more fittingly deal with fundamentals than the senior editor, an "ambulatory proctologist"?

The chapter on psychosomatic aspects of obstetrics and gynaecology is the work of Dr. W. S. Kroger and has largely been previously published by him in the journal *Obstetrics and Gynecology* of May, 1954. His views are well known to those who have read the book *Psychosomatic Gynecology* of which he is senior author. The emotional basis of symptoms is well recognized in gynaecology; Dr. Kroger considers that abortion may be similarly caused and he points out that the successful treatment of habitual abortion may be due in no small measure to the support obtained from the doctor-patient relationship.

"Premature Infants." By ETHEL C. DUNHAM. Second edition. Pp. xi + 459, with 51 figures. Cassell & Co., London. 1956. Price 63*s*.

DESPITE the great fall in infant mortality in recent years much avoidable wastage of life still occurs, especially in the neonatal period. The greatest scope for further progress lies in the prevention of prematurity and the better treatment of the premature baby. To illustrate the importance of the subject the author of this book points out in the preface that 270,000 babies born alive in the United States of America in 1950 (7·4 per cent of the total) weighed 5½ pounds or less, and that the mortality

in this group was 21 times as great as in those weighing more than 5½ pounds.

Part I deals with the incidence, prevention and the growth and development of premature infants; Part II with the physiological handicaps of the premature and its care, and Part III with the Public Health and statistical aspects of the subject. It is shown that the most important method of preventing prematurity is to improve the physique, health and diet of mothers. The improved care of the premature baby is reflected in the fall in mortality especially in those babies weighing over 1,500 g. In smaller babies immaturity of the tissues, especially of the lungs, is a serious obstacle to survival, nevertheless, those who do survive seem to develop satisfactorily. The most common lesions are emotional rather than physical.

Although this book is not very easy to read it is an exhaustive factual account of the problem and an excellent work of reference since each of its ten chapters has an extensive list of these and there are eleven appendices. There is no doubt that the book should be made readily available to anyone interested in the problems of prematurity.

"Progress in Clinical Obstetrics and Gynaecology." By T. L. T. Lewis, M.B., F.R.C.S., M.R.C.O.G. Pp. viii + 594, with 90 illustrations. J. & A. Churchill, Ltd., London. 1956. Price 55*s*.

This, the first edition, is divided equally into sections on obstetrics and gynaecology. In each, after an introductory résumé of the broad changes in practice, the author aims to present recent changes in outlook or modern trends of thought on a relatively wide range of subjects at post-graduate specialist level. Whilst the obstetric section deals with a variety of subjects, including the more important medical conditions associated with pregnancy, the gynaecological section deals in large part with tumours.

In each subject the post-war literature and even some of the pre-war literature has been widely reviewed in a factual synopsis and the author, rightly, makes no apology for the mass of statistical evidence presented to amplify the text. Apart from a few typing errors the material is well presented. Whilst the author is to be congratulated on the wealth of material which is compressed into a book of this size, a more critical opinion on his part would have been more desirable even at the expense of omitting some of the references.

The book should be of benefit to the specialist lacking facilities for keeping up with the literature and should prove a useful guide to further study for those reading for diploma and membership examinations.

"A Handbook of Medical Hypnosis." By Gordon Ambrose, L.M.S.S.A., and George Newbold, M.B., M.R.C.S., M.M.S.A., D.Obst.R.C.O.G., D.C.H. Pp. xiv + 256. Baillière, Tindall and Cox, London. 1956. Price 21*s*.

At a time when the medical uses of hypnosis are arousing considerable interest, the authors have produced this short textbook to serve as an introduction to the subject, and it is intended chiefly for students and general practitioners. After a description of the history of medical hypnotism the legal position of the practitioner in regard to its use is evaluated, and then the hypnotic state and the phenomena attendant on it are described in some detail. The emergence of psycho-somatic medicine as a definite entity has produced considerable interest in the possibilities of treatment of its manifestations. There is no doubt that stress is an important factor in the aetiology of organic disease, and the established methods of psycho-analysis are often so time-consuming as to render them of necessity available only to a relatively few sufferers.

In the chapter on hypnosis in general medicine, its use in the treatment of chronic dyspepsia and peptic ulcer, in chronic pulmonary tuberculosis and ulcerative colitis, rheumatoid arthritis, diabetes mellitus, essential hypertension, migraine, anorexia nervosa, and other conditions are described, and details of illustrative cases given, and its obvious application in the neuroses is discussed. A short section is devoted to the use of hypnosis in minor surgery and in promoting anaesthesia for dental extractions, and so on. The application of hypnosis to problems of paediatrics receives considerable attention, although it is not especially emphasized that the investigation and treatment of conditions in children such as delinquency, enuresis and stammering, require the most skilled investigation before recourse is had to such a form of therapy.

The reviewer was particularly interested in the section on the uses of hypnosis in gynaecology, because many patients who attend hospital as gynaecological outpatients have no detectable physical lesion, yet their lives are made miserable by distressing symptoms which are not amenable to ordinary measures of alleviation. Disturbances of menstruation such as functional uterine bleeding, amenorrhoea, pseudocyesis, and primary dysmenorrhoea, are all conditions in which treatment is at present primitive and often most disappointing. Here it would seem that the uses of hypnosis are well worth exploring, and according to the writers the results are often very rewarding. There is no doubt that leucorrhoea is often functional or psychogenic in origin, and that infertility has a considerable psychological element. Frigidity, pruritus vulvae and the menopause are all conditions in which the symptoms, to a large extent, outweigh the physical signs, and the authors consider that hypnotherapy is a promising line of management in these difficult conditions. While there is ordinarily no good reason for the employment of hypnosis in place of anaesthesia for minor operations, such as curettage, in patients in whom pelvic examination is difficult because of nervousness, or in whom there is pelvic pain of functional origin, there would seem to be considerable scope for its use.

Its use in obstetrics has aroused considerable interest in recent years. There are many reports of its effectiveness in hyperemesis gravidarum, and there is little doubt that the bond established between accoucheur and

patient during the repeated antenatal examinations is closely allied to hypnosis, so that the mere presence of the accoucheur instills confidence in the woman in labour. The multiplicity of distressing symptoms that are common in pregnancy—such as sleeplessness, pruritus, backache, heartburn, and so on—when there is no primary organic basis, are amenable to suggestion and hypnosis, and the writers outline their application to these conditions. The use of hypnosis during labour is described, and the writers obviously appreciate that its success is largely contingent on proper antenatal preparation.

Finally, there is a section on the uses of hypnosis in dermatology, and here there would seem to be a considerable field for its employment.

In the past, hypnosis has suffered from being exploited by non-medical persons, or has been employed as a blanket therapy, often without investigation of the underlying physical disorders. There is no doubt that the authors are to be congratulated in setting out in proper perspective the possible uses of hypnosis in therapy in the whole field of medicine. The book can be thoroughly recommended as an introduction to the subject.

REVIEW OF CURRENT LITERATURE

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OBSTETRICS

318. **The Way of an Obstetrician.**

By B. MAYES. *Med. J. Aust.*, **1**, 593–599. Apr. 14, 1956. 2 tables.

This lecture was delivered as a memorial to Arthur Wilson, a great obstetrician of Melbourne, who died in 1947. The main theme is the treatment of pre-eclampsia and the prevention of eclampsia. Arthur Wilson had stated that once a woman had a fit she moved from a column of pre-eclampsia with a mortality of 2 per cent to another column eclampsia with a mortality of 15 to 20 per cent. Mayes states that in pre-eclampsia the first red lamp of warning is the weight and "weight is water". Oedema is vitally important because it is insidious in onset and it interferes with function.

The diuretic drug Diamox has been given a trial at King George V Hospital on a small number of patients with toxaemia of pregnancy. The first impressions of it are that:

(1) It causes a rise in sodium excretion in the urine.
(2) With one exception, the total urinary volume rose.
(3) Only one patient lost weight.
(4) The blood pressure was not significantly affected.
(5) There was no constant effect on the patients' excretion of protein.
(6) The drug is worth a trial in the attack on oedema.

The author then discusses the rise of blood pressure and the relativity of the blood pressure (Wilson, *Med. J. Aust.*, 1946, **1**, 1). Protoveratrine given by injection as P.V.S. will lower the blood pressure when used for patients with very severe eclampsia, with rapidly progressing toxaemia during labour, with a rapid rise of blood pressure after delivery, or with severe toxaemia before the foetus is viable. The initial dose has been 0·1 mg. P.V.S. diluted in 10 ml. of 10 per cent glucose in distilled water, at least five minutes being taken for the injection, with a check on the blood pressure every 30 seconds. A second injection of a similar amount may be necessary.

The author advocates "a trial of pregnancy" for patients seen early in pregnancy with persistent albuminuria, as it is impossible to foretell which patient will deteriorate and which will not.

Arthur Wilson used to urge that eclampsia should be made a notifiable disease in Australia, as it has been for 30 years in New Zealand. Professor Mayes has also fought for this, and in a postscript, reports that the National Health and Medical Research Council has now agreed to recommend to the Government that eclampsia be made a notifiable disease.

S. Devenish Meares

319. **Some Obstetrical Problems Encountered in General Practice.**

By A. ROSIN. *S. Afr. med. J.*, **30**, 407–409. Apr. 28, 1956.

The author deals with numerous problems which he has met in general practice.

False labour pains can be severe. It is important not to resort to heroic procedures because of lack of progress in a patient who is merely having false pains.

The importance of pelvic assessment is stressed, particularly prior to the application of forceps.

Diagnosis of postmaturity may be difficult. The author feels that the state of the cervix may be very helpful in reaching a conclusion.

He warns against vaginal examination in cases of premature rupture of the membranes during pregnancy.

With regard to premature labour, vitamin K should be administered to the mother. The importance of an episiotomy is stressed in these cases, as it is far better to have a tear in the perineum than in the falx cerebri.

The dangers of Credé's expression are discussed.

Patients on salt-free diets should be told about foods and medicines containing sodium, and not only about the salt cellar.

The advantages of lower-segment Caesarean section are discussed. Foetal apnoea may be caused by too much time being spent tying small superficial vessels.

Manual removal of the placenta should not be performed without an indication. It is felt that intravenous ergometrine with the birth of the head is a very satisfactory procedure.

The difficulties of blood transfusion in a country practice are discussed.

The author describes a routine scheme of examination in patients with puerperal pyrexia.

L. J. Abramowitz

320. **Grand Multiparity: Survey and Appraisal.**

By J. M. KREBS. *Obstet. Gynec.*, **7**, 433–443. Apr. 1956. 1 fig. 5 tables. 9 refs.

The author presents a survey and appraisal of grand multiparity in 532 mothers with 7 or more viable children.

Sixty-six spent more than 12 hours in labour, of which 7 were in labour more than 24 hours. Almost three quarters of the total group were in labour 8 hours or less. In 55 low forceps delivery was performed and these, together with the normal deliveries, formed 96·4 per cent of the whole. There were 3 mid-forceps deliveries, 12 Caesarean sections, and 4 version-extractions. Eleven women had twins.

Placenta praevia was no commoner than in the total deliveries at the hospital, and retained placenta and postpartum haemorrhage were rarer. The stillbirth rate was about the same, but neonatal deaths were more frequent (2·06 per cent compared with 1·5 per cent). There was one ruptured uterus due to manual dilatation of the cervix. Malpresentations were not more common in the grand multiparae nor was toxaemia. There were no maternal deaths in the 532 mothers.

J. G. Dumoulin

321. **Use of Cortisone in Obstetrics and Gynaecology.** (Il cortisone in ostetricia e ginecologia.)

By E. MAURIZIO and N. PASETTO. *Minerva ginec., Torino*, **8**. Feb. 29, 1956. 120 refs.

Extensions to the use of cortisone and its allies in all branches of medicine are constantly being proclaimed, but in the fields of obstetrics and gynaecology its usefulness still needs investigation. After discussing the theories of interaction of the female hormones under the master control of the anterior pituitary gland, the authors consider the use of cortisone to correct centrally through this gland disorders such as anovular menstruation and hirsutism due to excess production of androgens. Control of the cases selected for treatment involved not only a watch on the clinical effects produced but regular endometrial biopsies and estimations of pregnanediol excretion. In addition, the obvious danger of undue suppression of the normal cortico-adrenal activity had to be kept in mind. Animal experiments, too, had indicated the need for caution: a high percentage of progeny of pregnant rats treated with cortisone for four consecutive days had been abnormal.

In addition to cortisone, an allied synthetic preparation, Prednisone (metacortandracin), was used, which was found to be about five times as potent as cortisone but in every way similar in its effects.

Results: Toxaemias of pregnancy—no benefits observed. Hyperemesis—excellent effect in 23 out of 29 cases [this, of course, is quite inconclusive]. Obstetric shock—found to be of great value. In gynaecology, anovular menstruation and hirsutism associated with hyperandrogenism were found to respond very favourably. In anovular menstruation the preparations were given from the 8th to the 19th day. Dosage: days 8 to 14 cortisone mg. 75 daily (mg. 15 of prednisone), and days 15 to 19 two-thirds of the above dosage. The results in a small series of cases, were described as very encouraging and no ill effects were noted. The menstrual cycles were usually restored with normal ovulation within two to three months. [Other lines of treatment for these disorders being extremely disappointing, the possibilities of cortisone appear well worth extended trial.]

W. C. Spackman

PREGNANCY

322. **Pregnancy at Age of 56 Years.**

By A. E. ANDERSON. *Obstet. Gynec.*, **7**, 494–495. May 1956. 3 figs. 1 ref.

A case is presented of an abortion occurring in a patient age 56 years. Necrotic tissue removed at curettage showed "the presence of recognizable placental villi".

J. G. Dumoulin

323. **Cervical Changes in Pregnancy: A Contribution to the Problem of Epidermization.** (Die Cervixveränderungen in der Schwangerschaft: Beitrag zur Frage der Epidermization.)

By H. MEINRENKER. *Arch. Gynäk.*, **187**, 501–518. 1956. 7 figs. 52 refs.

Three hundred and sixty-three cervical punch biopsies

of pregnant women were examined to investigate morphologic changes of the columnar epithelium and the cervical glands during pregnancy. Abnormalities such as vacuolization, glandular hyperplasia and epidermization were noticed in 89 specimens. Epidermization seemed to be dependent on vacuolization, starting as a single squamous layer and developing later into several layers but remaining sharply demarcated by a basal membrane. As the squamous epithelium increased in thickness, the vacuoles advanced towards the glandular lumen and the overlying columnar epithelium showed degenerative changes. Finally the columnar and vacuolized layers were desquamated into the cervical canal and only the many-tiered squamous layer persisted.

Anatomically this process is described as degeneration, hyperplasia and metaplasia. The author attributes the aetiology of these changes to oestrogen effects and inflammatory changes of the fibrous tissue. Similar changes may occur at any age, but they are seen more often and in greater quantity at times of hormonal upheaval, e.g., in the newborn, during pregnancy and early in the menopause. They do not affect every pregnant woman and seem to depend on individual disposition and external factors as yet unknown. They represent a definite histological pattern and can easily be distinguished from carcinoma *in situ*.

Erica Wachtel

324. **A Chemical Method of Estimating the Amount of the Liquor Amnii During Pregnancy.** (Metodo chimico di mizurazione del liquido amniotico nel corso della gravidanza.)

By M. COTTAFAVI. *Minerva ginec., Torino*, **8**, 234–236. Mar. 15, 1956. 1 fig. 5 refs.

It is often of interest and sometimes of importance to know the volume of the liquor amnii during pregnancy. Moreover, in certain research problems connected with foeto-maternal metabolism it may be essential to obtain this information. At what rate is it secreted if a quantity is withdrawn? A number of similar problems suggest themselves, connected with both normal and abnormal conditions of mother and child.

Methods employed during pregnancy involve the injection of dyes or chemicals (e.g., inulin) into the amniotic sac through the abdominal wall and, after causing adequate admixture and dilution with the liquor amnii by external manipulation of the foetus, withdrawal of a quantity for estimation by colorimetry or analysis. The author experimented on 15 women near term in connexion with estimations being made of variations of amniotic pressures and not for suspected abnormalities in amount of liquor amnii. The substance used was poly-vinyl-pyrollidone (subtosan). This is non-toxic to mother and child, stable, and easily miscible with organic liquids, and its estimation can be assessed by simple chemical means. 1 ml. of this substance in 25 per cent solution after dilution by barbotage with 20 ml. of liquor amnii is injected into the amniotic sac through the abdominal wall. Barbotage is repeated to clear the syringe adequately and the needle is then withdrawn. After ballottement of the foetus sufficient to ensure good mixing, two samples are withdrawn after 15 and 20 minutes respectively for analysis. The average amount of liquor amnii in the 15 cases was found to be 750 ml., the maximum and minimum being 1,515 ml. and 550 ml. showing how wide the difference can be even in cases when this was not expected.

W. C. Spackman

325. **Toxaemia of Pregnancy in Relation to Chronic Hypertension.**

By L. C. CHESLEY. *West. J. Surg. Obstet. Gynec.*, **64**, 284–286. May 1956.

The author reconsiders his previous views that pre-eclampsia causes permanent hypertension. Many patients have unrecognized hypertensive disease before pregnancy and in these the blood pressure tends to fall in the early months of pregnancy, only later rising to its normal level, this being regarded as the onset of hypertension; these patients will have hypertension at a follow-up examination because they had it before pregnancy. This type of patient may also develop mild oedema and proteinuria during the third trimester and be labelled as a mild "toxaemia" and therefore weight the data to show a correlation between duration of the pre-eclampsia and the incidence of later hypertension. It seems unlikely that pure pre-eclampsia causes a later hypertension, but it may, occasionally, precipitate a hypertension that was in the making.

D. C. A. Bevis

326. **Psychiatric Investigation of Habitual Abortion.**

By E. C. MANN. *Obstet. Gynec.*, **7**, 589–601. June 1956. 20 refs.

The fact that numerous different forms of treatment for habitual abortion have been reported as successful has led to the suggestion that there may be a relationship between emotional factors and habitual abortion.

A special clinic was set up at the New York Lying-In Hospital to study cases who had had 3 previous abortions for no obvious reason. This report concerns 24 cases, 20 of whom delivered normal living infants and 4 (16·6 per cent) aborted. All these women were remarkably alike in their personality make-up. They developed, at home, an intense dependency upon their mothers, whilst their fathers were literally or figuratively lost to them early in their lives. When they marry they find femininity, particularly as it relates to motherhood, difficult, if not hazardous.

In the 4 cases that aborted, the pattern was the same. Three or 4 days before abortion the cervix became effaced and painlessly dilated so that the membranes herniated—described by the author as gestational incontinence of the cervix. He regards this as a physiological defect rather than an anatomical one. In each case and in some threatened abortions the onset of trouble could be predicted before there were symptoms on the basis of sudden emotional changes as manifested by childishness, petulance, anxiety, and loss of motivation.

Treatment, consequently, is directed to maintaining the patient's motivation toward motherhood at a sufficiently high level to withstand these tendencies.

J. G. Dumoulin

327. **Habitual Abortion: Therapeutic Evaluation of Citrus Bioflavonoids. Report on Twenty-five Cases.**

By F. A. TAYLOR. *West. J. Surg. Obstet. Gynec.*, **64**, 280–283. May 1956. 11 refs.

The citrus bioflavonoids (Vitamin P) decrease the fragility of capillaries and prevent protein leakage through the capillary wall. Nineteen patients were treated with the compound for periods of 1 to 8 months, 14 being delivered at or near term; the author gained the impression that post-partum bleeding was lessened and that haematoma formation following episiotomy was also lessened. Six patients with threatened abortion were also treated, a satisfactory result being obtained in 4 cases.

[There is considerable doubt as to what constitutes habitual abortion, no indication being given in this paper of the number of previous abortions of the majority of the patients, the two cases given with any detail both having 2 previous abortions. The value of the treatment seems to be somewhat doubtful.]

D. C. A. Bevis

328. **Mitral Valvotomy in Pregnancy.** (Considerazioni ostetriche sui primi resultati della commissurotomia mitralica in gravidanza.)

By P. N. SILIQUINI and E. REVELLI. *Minerva ginec., Torino*, **8**, 295–306. Apr. 15, 1956. 15 figs. 29 refs.

This article reports on six cases of mitral stenosis in pregnant women showing evidence of present or past decompensation who were operated upon by valvotomy. In every case great benefit was obtained by the patient and in five the pregnancy proceeded smoothly. One patient aborted spontaneously 15 days after the operation. This case was dramatic in that whilst the patient was on the table awaiting anaesthesia immediately before the commencement of the valvotomy she developed acute pulmonary oedema. Intravenous anaesthesia followed after intubation by forced oxygen enabled a rapid dilatation of the affected heart valve to be carried out which relieved the emergency, and the patient ultimately left the clinic with the cardiovascular system in good condition. The article is illustrated by electrocardiographs and X-rays and a detailed account of each case, together with a discussion and review of the literature.

W. C. Spackman

329. **Rupture of the Spleen in Pregnancy.**

By D. W. MOORE. *West. J. Surg. Obstet. Gynec.*, **64**, 306–315. June 1956. 19 refs.

Rupture of the spleen in pregnancy may be classified as traumatic, pathological (where there is frank splenic disease as in malaria, Banti's disease, the blood dyscrasias, etc.) or spontaneous. The rupture may involve both pulp and capsule in which case there is immediate and severe intra-abdominal haemorrhage and rapidly developing shock and death, or there may be fracture of the pulp only and the capsule remain intact until the subcapsular haematoma tears it. The clinical picture varies with the type and extent of the tear, but cardinal symptoms are sudden pain in the left upper quadrant and epigastrium often referred to the left or both shoulders, rapidly developing generalized abdominal pain often accompanied by nausea and vomiting, and signs of intraperitoneal bleeding and shock. The differential diagnosis includes uterine rupture and abruptio placentae, but in rupture of the spleen the foetal heart sounds do not disappear until the maternal shock reduces the placental blood flow. Treatment is immediate splenectomy, an operation of no particular difficulty provided adequate exposure is obtained. The organ should be lifted from its bed and the pedicle ligated as close to the hilum as possible. If exposure of the spleen is difficult, the uterus should be emptied first by the most expedient type of Caesarean section.

The author reviews 28 cases discovered in the literature since 1803, and adds 4 of his own. The gross mortality was 53 per cent, but modern anaesthesia and blood transfusion should materially reduce this. Of 20 cases described since 1932, 5 died, 2 before surgery could be performed.

D. C. A. Bevis

330. **Congenital Abnormalities of the Uterus and Pregnancy.**

By J. A. HOLMES. *Brit. med. J.*, **1**, 1144–1147. May 19, 1956. 4 figs. 18 refs.

The author, from St. James' Hospital, London, reviews the literature on congenital uterine abnormalities and pregnancy and describes a further nine cases. He finds that the incidence is about 1 in 1,000 cases. He follows Jarcho's classification: (1) failure of fusion, causing: (*a*) uterus pseudodidelphys; (*b*) uterus duplex bicornis bicollis; vagina simplex, and (*c*) uterus bicornis unicollis; vagina simplex.

(2) Persistence or partial persistence of the septum: (*d*) uterus septus; (*e*) uterus subseptus; (*f*) uterus arcuatus.

(3) Failure of one side to develop: (*g*) uterus unicollis.

He stresses the fact that congenital abnormality of the urinary tract is frequently found.

The diagnosis may be suggested by the presence of a vaginal septum, or two cervices, or following uterosalpingography prior to pregnancy.

The ante-partum complications are chiefly of recurrent abortion, especially liable to occur in types *C*, *D* and *E*.

Malpresentations are common, especially transverse lie and breech. There was an increased incidence of twins. Premature labour was more common in all types. There was an increased risk of retained placenta and post-partum haemorrhage. The vaginal septum may obstruct the second stage and require incision.

The foetal mortality is related to the type of abnormality, being greatest in types *C*, *E* and *F*.

Eileen Wilson

331. **Rupture of the Uterus.**

By A. A. LININGTON. *S. Afr. med. J.*, **30**, 516–518. June 2, 1956.

The author describes 18 cases of rupture of the uterus which occurred at the Sinoia Native Hospital, Southern Rhodesia, since 1947.

Two cases followed previous Caesarean section, one

a classical and the other a lower-segment operation. Both patients recovered. One patient died following incomplete rupture of the fundus. There were 15 cases of spontaneous rupture of the lower segment. Six of these patients died, the mortality being 40 per cent. Of the 9 cases who recovered, 2 were treated by hysterectomy and 7 by suture of the wound.

The commonest cause of rupture in this series was an inadequate maternal pelvis, this occurring in 11 cases. Malpresentation and hydrocephalus were each responsible for 2 cases, and prolonged delay in delivery of a second twin was responsible for one case.

Early diagnosis and adequate blood transfusion are essential for satisfactory treatment. The author claims that 4 deaths might have been prevented had blood been available.

A plea is made for conservation of the uterus in young women. A native woman without a uterus is valueless to the male. He will divorce her sooner or later and she becomes a social out-cast.

L. J. Abramowitz

332. **Tetanus Complicating Pregnancy: Report of a Case Treated with Chlorpromazine with Survival of Both Mother and Infant.**

By A. R. Singleton, Jr. and R. W. Witt. *Obstet. Gynec.*, 7, 540–541. May 1956. 3 refs.

A case of tetanus occurring in a negro patient 7 months pregnant is described. Seven days before admission she had grazed her elbow. Intravenous, followed by intramuscular, tetanus antitoxin was given, together with penicillin and streptomycin. Phenobarbitone and mephenesin were used for sedation. Tracheotomy was performed. Two weeks after admission, bronchopneumonia developed. Tetracycline was given, but pyrexia continued.

On the third hospital day chlorpromazine was given intravenously which dramatically controlled the clonic convulsions. Thereafter, it was used intramuscularly for 2 weeks.

Twenty-four days after admission the patient went into labour. She was delivered by forceps of a living infant under pudendal block.

This is the first known case of survival of mother and infant.

J. G. Dumoulin

333. **Toxoplasmosis in Obstetrics.** (Токсоплазмоз в акушерстве.)

By L. G. Syepanov. *Akush. Ginec.*, No. 1, 64–66. Jan./Feb. 1956.

The appearance in the newborn of convulsions, pareses, tremor, nuchal rigidity or muscular hypotension, and the presence in the C.S.F. of albumen or xanthochromia, makes the exclusion of toxoplasmosis essential —as should the presence of anomalous development or deformities. Visceral forms of the disease may also occur. Investigation of mother as well as of the child is necessary. In the child and in later age-groups the disease may manifest itself in physical and intellectual retardation, and especially in rigidity combined with convulsions and vomiting of central origin.

Examination for toxoplasmosis includes a careful epidemiological and obstetric anamnesis (e.g., occupation, contact with animals, etc.), clinical examination including the optic disc, radiological study of the brain for calcified foci, serological and parasitological investigation of the C.S.F. and of blood from the umbilical vein, and in fatal cases microscopical study of portions of the brain, liver, and spleen.

Chorioretinitis was found in 99 per cent of 103 cases by Feldman, and calcified foci in the brain in 63 per cent. Hydrocephaly, microcephaly, hepatomegaly, pyrexia, jaundice and xanthochromia of the C.S.F. were also described by Eichenwald in newborn infants suffering from toxoplasmosis.

L. Firman-Edwards

334. **Diagnosis of Ectopic Pregnancy.**

By L. T. Hibbard. *Obstet. Gynec.*, 7, 453–458. Apr. 1956. 4 tables. 5 refs.

Ectopic gestation is a frequent finding at the Los Angeles County General Hospital where 537 cases were seen in a 5-year period up to 1953. In a study of these cases, the author points out the difficulties in reaching a diagnosis, and the delays. He believes that pregnancy tests, curettage of the uterus and serial haemoglobin estimations are too inaccurate to be useful.

Two tests, however, did prove valuable—needling the posterior fornix and paracentesis. In the latter, a site is chosen 2 inches above the inguinal ligament and lateral to the rectus sheath. Both tests are used to demonstrate intraperitoneal blood. The author discusses the snags, but his results are impressive. In 428 patients, 355 were subjected to colpocentesis and 73 to paracentesis. The overall accuracy in diagnosis was 96 per cent.

J. G. Dumoulin

LABOUR

335. **Vaginal Examinations in Labour.**

By G. Schaefer, F. Carpenter and B. F. Labriola. *Obstet. Gynec.*, 7, 390–395. Apr. 1956. 8 tables. 3 refs.

The following figures give the incidence of postpartum fever (temperature of 100·4° F. on any 2 days following the first 24 hours) in 3,637 patients delivered in 1951 at Flushing Hospital, New York:

Examinations performed during labour

	No.	Per cent	No. with fever
Vaginal only	1,061	29·2	27
Rectal only	1,163	32	32
Vaginal and rectal ..	1,127	31	29
No examination ..	286	7·8	8

Thus, the type of examination did not appear to have any bearing on the incidence of fever.

An analysis of the number of vaginal examinations showed:

No. of examinations	No. of patients	Per cent	Per cent with fever
1	656	61·8	2·4
2	284	26·8	2·4
3	98	9·2	3·1
4	18	1·7	5·5
5	5	0·4	0

The authors suggest that the dangers of post-partum infection following vaginal examination have been exaggerated in the past.

J. G. Dumoulin

336. **Artificial "Ripening" of the Cervix with Intravenous Pitocin.** (Maduración artificial del cervix con Pitocin endovenoso.)

By L. Castelazo Ayala. *Ann. Ostet. Ginec.*, **77**, 917–922. 1955. 2 tables. 20 refs.

It has been found possible to produce "ripening" of the cervix in the latter months of pregnancy by intravenous injection of pitocin. The method has been used in 46 women from 31 to 38 weeks pregnant. It consists in the intravenous injection of a solution of pitocin 0·2 to 0·5 : 1,000 in 5 per cent glucose solution. The solution is given continuously at the rate of 10 to 20 drops per minute. Vaginal delivery occurred in all but two cases. One was a case of severe toxaemia and the pregnancy was terminated as a matter of urgency by Caesarean section. The other case showed marked hypertonia of the uterus in response to the injection and was ultimately delivered of a macerated foetus. Normal vaginal delivery occurred in all the remaining 44 cases.

The author concludes that the continuous intravenous administration of pitocin is useful in producing ripening of the cervix, especially in cases where the cervix is hard and not taken up.

Josephine Barnes

337. **Synthetic Oxytocin.**

By M. N. Bainbridge, W. C. W. Nixon, H. O. Schild and C. N. Smyth. *Brit. med. J.*, **1**, 1133–1135. May 19, 1956. 5 figs. 8 refs.

The authors have carried out a clinical trial of a synthetic oxytocin—syntocinon (Sandoz Ltd.) at the University College Obstetric Hospital, London. Syntocinon has been standardized to be equal in potency to posterior pituitary powder at 10 international units to 1 ml. Their trials consisted of three groups—(*a*) antepartum, in cases of therapeutic abortion; (*b*) intrapartum, where oxytocin infusions were given for certain types of uterine inertia; and (*c*) post-partum, to assay the drug statistically by a modification of the method of Myerscough and Schild.

In the ante-partum investigation an electrical pressure transducer of the Ingelman-Sundberg type was introduced in the cervical canal of an anaesthetized patient preparatory to evacuation of the uterus. Alternate injections of oxytocin and syntocinon were given intravenously to the same patient at 10-minute intervals. The effects of oxytocin and syntocinon were qualitatively similar.

In the intra-partum tests, the infusions were of strength 10 units/litre and the rate of administration varied from 7–30 drops a minute. Contractility was continuously recorded with an electric tocograph. The two preparations were closely similar in potency.

In the post-partum assay a gauge recorded the contractility of the uterus through the abdominal wall. The assay was carried out on 54 patients and a graph of the results plotted, the "log-dose" being plotted against "time of action". Each patient received only equal doses of the same drug, given on the second and third post-partum day. No qualitative or quantitative difference between the two compounds was demonstrated and no side effects were encountered.

Eileen Wilson

338. **Clinical Trial of Synthetic Oxytocin.**

By H. H. Francis and W. J. A. Francis. *Brit. med. J.*, **1**, 1136–1137. May 19, 1956. 3 figs. 14 refs.

The synthetic oxytocin used was syntocinon (Sandoz Ltd.)—standardized biologically to 10 international units per ml. Pitocin was used as a control. The authors made this clinical trial on 31 patients near term or in labour at the Liverpool Maternity and Mill Road Maternity Hospitals.

The drug was used as follows:

(*a*) For induction of labour:

- (1) Oxytocin alone - 5 cases.
- (2) Oxytocin as a preliminary to artificial rupture of the membranes - 4 cases.
- (3) Oxytocin and artificial rupture of membranes combined - 4 cases.

(*b*) For inefficient uterine action:

- (1) Failed induction of labour by artificial rupture of the membranes - 6 cases.
- (2) Hypotonic inertia during the first or second stage of labour - 12 cases.

Syntocinon was administered by intravenous drip infusion of 5 per cent dextrose solution containing 2·5 I.U., 5 I.U., or 10 I.U. per litre. The rate of drip was regulated according to the uterine response, as measured by a Lorand tocograph. The blood pressure and foetal heart rates were measured at 20-minute intervals.

Syntocinon proved strongly oxytocic in all cases, and the type, amplitude and frequency of uterine contractions were indistinguishable from those produced by the same dose of pitocin.

There were no untoward side effects. The authors feel that, as with pitocin, the optimum concentration of infusion is 5 I.U. per litre. There was no appreciable difference in the rise of blood pressure following the intermittent administration. The rise following continuous administration was similar to that observed during

untreated labour, but a slight pressor effect could not be excluded. The authors felt that this was not sufficient to contra-indicate its use in therapeutic dosage.

Eileen Wilson

339. **Primary Cervical Dystocia Treated with Caudal Analgesia.**

By H. C. J. BALL and J. S. W. CHAMBERS. *Brit. med. J.*, 1, 1275–1277. June 2, 1956. 5 refs.

The authors describe three cases of cervical dystocia occurring at the Southampton General Hospital, successfully treated by caudal analgesia. All three were primigravidae, who had apparently been in strong labour without disproportion for over 50 hours. In all three cases the cervix was thin, and fully effaced, but with the head extremely tightly applied and with no progress in dilatation. After caudal analgesia was administered, the cervix rapidly became fully dilated, the time taken in the three cases varying from 30 minutes to 2 hours. Delivery was easily accomplished by forceps in two cases, and spontaneously in the third case.

The technique of administration was as follows: With the patient in the left lateral position, a malleable needle was inserted into the sacral canal through the posterior sacrococcygeal membrane, protected by a dressing and strapped to the skin. After aspiration to test for blood or cerebrospinal fluid, a test dose of 5 ml. of 1·5 per cent piperocaine hydrochloride was injected. If after five minutes there was no evidence of dural puncture, the needle was connected by high-pressure tubing to a syringe and a further 30 to 40 ml. of piperocaine hydrochloride given. The patient was kept supine for 15 minutes and then returned to the lateral position. Further doses of 10 to 30 ml. could be repeated in half to one and a half hours as required.

The writers agree with Jeffcoate that three constant factors should be present for the diagnosis of primary cervical dystocia: a foetal head deeply engaged, strong regular uterine contractions, and a thin cervix with a rigid external os only partially dilated after a long first-stage of labour. They feel that caudal analgesia is worthy of a trial before resorting to Caesarean section.

Eileen Wilson

340. **Intra-partum Proteinuria.**

By R. MORTON and L. C. CHESLEY. *Obstet. Gynec.*, 7, 373–377. Apr. 1956. 3 tables. 9 refs.

This is a study of the incidence of proteinuria occurring during labour in cases which had previously shown no evidence of proteinuria, toxaemia of pregnancy or haematuria. Of the 500 "normal" cases studied, 155 (31 per cent) developed albuminuria during labour. Certain groups of patients had a statistically significant increase in the incidence of proteinuria: primigravidae had a 46·7 per cent incidence as against 26 per cent in multiparae. When the second stage lasted more than 1 hour, the incidence increased. An increased incidence was also noted in anaemic patients, with trilene analgesia, and with a first stage longer than 12 hours. The time at which the membranes ruptured did not seem to make any difference.

J. G. Dumoulin

341. **Placenta Previa and Accreta: Report of Two Cases.**

By D. V. WACHSMAN and G. L. MOORE. *Obstet. Gynec.*, 7, 399–405. Apr. 1956. 2 figs. 1 col. plate. 8 refs.

Placenta praevia et accreta is probably not as rare as the 33 reported cases would indicate. The authors add 2 cases. In the first, the patient had a post-partum haemorrhage which was treated by gentle curettage and uterine packing. Three weeks later she was re-admitted because of profuse vaginal bleeding. Total hysterectomy was carried out. There was a polypoid mass of necrotic chorionic tissue chiefly in the upper cervical canal, thought to have been part of a succenturiate lobe. Microscopic examination showed placenta increta, the villi being present deep in the myometrial layer.

In the second case, the placenta did not separate and attempted manual removal proved it to be adherent. The uterus was packed. Five days post-partum manual removal of the placental fragments was again tried, resulting in heavy bleeding. Hysterectomy was carried out. The microscopic examination showed placenta accreta vera, only a layer of fibrin separating the villi from myometrium.

J. G. Dumoulin

342. **Obstetric Indications for the Use of Pudendal Nerve Block Analgesia.**

By I. ROCKER. *Brit. med. J.*, 2, 78–81. July 14, 1956. 14 refs.

The author, from the United Cambridge Hospitals, contrasts the dangers of inhalation anaesthesia in the unprepared patient with the advantages of pudendal nerve block. He uses a mixture containing 1 per cent procaine or 1 per cent lignocaine.

In a series of 57 patients (38 primigravidae) the first 19 cases had procaine blocks, and in the remainder lignocaine was employed. To 50 ml. of analgesic, 0·5 ml. of 1 in 1,000 adrenaline was first added and then 1,000 units of hyaluronidase. A total of 30 to 40 ml. of solution was used. Lignocaine was effective in a shorter time than the procaine mixture.

The skin infiltration was begun at a point midway between the anus and ischial tuberosity, using a fine 5-inch needle. Aspiration is important to prevent intravenous injection. Skin infiltration of the vulva was performed to block any filament from the ilio-inguinal nerve. A further injection into the deeper tissues ensured analgesia in those cases where the inferior haemorrhoidal nerve arises as a separate branch from S.4.

Pudendal nerve block gave safe and effective analgesia for low forceps delivery, assisted breech delivery and repair of severe lacerations. The contra-indications were: (1) The necessity for intra-uterine or high vaginal manipulations. (2) Vulval sepsis, oedema, or varicose veins. (3) Nervous patients. Pudendal nerve block is particularly useful in domiciliary obstetric practice.

Eileen Wilson

OPERATIONS

343. **Cesarean Sections. A Five-Year Statewide Survey in Iowa, 1949–53.**

By M. M. DONNELLY. *Obstet. Gynec.*, 7, 412–417. Apr. 1956. 5 tables. 5 refs.

A statewide survey in Iowa for the period 1949–53 has been carried out by the author based on birth certificates from 321,931 live births. The section rate was 36·9 per 1,000 live births as compared with 10 in 1930–32. There were 177 maternal deaths during the period, an overall rate of 5·5 per 10,000 live births. Thirty-eight of these deaths followed Caesarean section, giving a rate of 32 per 10,000 sections.

The perinatal death rate for the 11,632 infants delivered by Caesarean section was 73·3 as opposed to the total perinatal death rate of 32·9.

In the hospitals in which the Caesarean section rate was high, the increase tended to be in older multiparae. A number of these were sterilized at the same time.

J. G. Dumoulin

344. **Reflections on Cesarean Section. A Twenty-Year Review of Cesarean Section in an Open Staff Private Hospital.**

By J. W. SHERRICK and M. THEBAUT. *West. J. Surg. Obstet. Gynec.*, **64**, 250–268. May 1956.

The authors consider the results obtained from 1928 to 1955 in a 220-bed hospital served by 110 physicians, 37 being trained obstetricians. There were 31,920 deliveries, 3,306 of these being sections. Two thousand and ninety-two (63 per cent) of the sections were elective. Fifty per cent were repeats, 43 per cent were for "potential dystocia", and the remaining 7 per cent were done for maternal disease. The authors are very emphatic about the dictum "once a section, always a section". In the whole series there were 7 maternal deaths, the last one being in 1941; 2,286 operations have been performed since then without a death.

D. C. A. Bevis

345. **Patients with Four or More Cesarean Sections.**

By H. B. MCNALLY and V. DE P. FITZPATRICK. *J. Amer. med. Ass.*, **160**, 1005–1010. Mar. 24, 1956. 16 refs.

It has been a common practice in the past to sterilize patients who have had two Caesarean sections, but recently it has been suggested that there should be no set limit, providing the integrity of the uterus is maintained. From the Department of Obstetrics, University of Maryland, the authors present a survey of 130 patients who had four or more Caesarean sections in 20 hospitals operating under religious supervision, where sterilization in the absence of disease of the reproductive organs is forbidden.

The indications for the initial Caesarean section as well as for subsequent sections fell into generally accepted categories. There was only one maternal death in the series and this occurred during the repair of a ventral hernia following the section. Risk of prematurity of the baby was found to be greater in patients with multiple sections. Ten hysterectomies were performed and a total of 32 (24·6 per cent) defective scars were reported. The distension of the uterus by an advancing pregnancy as a cause of weakened scar is more to be feared than labour, and previous post-operative infection does not always cause subsequent weakness of post-section scars. The authors conclude that the capabilities of the uterus after multiple section have been underestimated.

D. W. James

346. **Use of Transverse Suture of the Cervix Uteri in Controlling Atonic Post-partum Haemorrhage.** (Применение поперечного шва на шейку матки при атонических кровотечениях в раннем послеродовом периоде.)

By V. A. LOSITSKAYA. *Akush. Ginec.*, No. 1, 28–30, Jan./Feb. 1956.

The posterior aspect of the cervix uteri and the upper posterior wall of the vagina are rich in sensory nerve-endings and form an important reflexogenic zone. The insertion of a transverse catgut suture through the torn cervix was found to result in the cessation of haemorrhage and the uterus became hard and firm. At first this technique was used by the authoress only after previous massage, the use of oxytocic drugs, manual exploration of the uterus and tamponade. Later it was resorted to at once, after evacuation of the bladder and expression of uterine clots.

The suture needle should pass transversely through all the layers of the cervix from left to right, emerging 4–4·5 cm. from its point of insertion. Out of 40 cases, only one failed to react to this treatment by cessation of bleeding. The technique is simple, and far safer than more complicated measures. It appears to depend on cutting off inhibitory reflex impulses to the uterine musculature.

L. Firman-Edwards

MATERNAL MORTALITY

347. **Maternal Death from Aspiration Asphyxia.**

By R. B. PARKER. *Brit. med. J.*, **2**, 16–19. July 7, 1956. 24 refs.

In the United States of America, spinal, intravenous and inhalation anaesthetics are responsible for 2–10 per cent of all maternal deaths, and in one-third to one-half of cases death is due to aspiration of vomit.

The Ministry of Health Report, 1953, shows that 4·1 per cent of all maternal deaths occurring in England and Wales during 1952 and 1953 were due to anaesthesia, but there has been no assay in this country of the frequency of aspiration of vomit during anaesthesia as a cause of maternal death. This report is an attempt to make good the deficiency and 8 cases are reported.

These occurred in the City of Birmingham during the years 1943 to 1952 inclusive, when 215,000 confinements and 205 maternal deaths (0·9 per 1,000 confinements) occurred, so that the incidence of aspiration asphyxia as a cause of maternal death was 3·9 per cent.

During the years under review over 3,000 forceps deliveries were performed safely in domiciliary practice, whereas 4 deaths due to aspiration occurred in 2,200 deliveries in the Birmingham Maternity Hospitals. Suspicion falls on the anaesthetic machine, and the unskilled occasional anaesthetist might be wise to use the open mask rather than the Boyle machine.

If inhalation anaesthesia must be used, then its

administration should be in the hands of a skilled anaesthetist who will ensure that the patient's stomach is empty and may use a cuffed endotracheal tube. The use of a transparent face piece will lead to the early recognition of silent regurgitation. Other recommendations include consideration of the left lateral position for forceps deliveries and also the use of an operating table rather than an obstetric delivery bed, as the former can be rapidly tilted in both directions. The hazard of aspiration asphyxia may be avoided in about 60 per cent of forceps deliveries by the use of local analgesia.

R. W. Grayburn

348. **Disseminated, Fatal, Post-Partum Candidiasis with Renal Suppuration: Case Report.**

By J. B. DAVIS, J. D. WHITAKER, L. K. DING and J. H. KIEFER. *J. Urol.*, 75, 930–936. June 1956. 1 fig. 33 refs.

A woman aged 29 with severe spastic paralysis and contractures due to multiple sclerosis had a Caesarean section. She was given routine treatment of penicillin and streptomycin for four days after the operation as a prophylactic. On the seventh day she developed retention of urine and a catheter was passed. On the tenth day there were signs of subacute bacterial endocarditis and terramycin was given. An intravenous pyelogram revealed a non-functioning left kidney with obstruction in the upper part of the ureter. A nephrectomy was performed. The kidney contained multiple abscesses and the obstruction in the upper ureter was due to a mass of material containing pus and *Candida albicans*. *Candida albicans* was also obtained from the renal abscesses.

The patient continued to run a septic course with signs of lung collapse and thrombophlebitis of the veins in the pelvis occurred. She was now given furadantin, polymyxin and penicillin without effect. Death occurred seventy-six days after the Caesarean section. At autopsy the findings were septicaemia, peritonitis and lower nephron nephritis.

It was thought that the patient had vaginal thrush which was introduced into the bladder by the catheter, and that dissemination then followed.

The danger of routine prophylactic antibiotic treatment in chronically debilitated patients is discussed. A full review of the literature is included in the paper.

J. H. Carver

INFANT

349. **Fixation of I_{131} by the Human Foetal Thyroid.** (Sulla fissazione dello I_{131} da parte della tiroide fetale umana.)

By S. AVANZINI and U. MARINONI. *Ann. Ostet. Ginec.*, 77, 893–896. 1955. 2 figs. 5 refs.

A study of the literature indicates that the thyroid of the human foetus is capable of fixing I_{131} by the 12th week of gestation.

Two living aborted foetuses have been studied, the first of five months and twenty-five days and the second of three months and ten days. The duration of pregnancy was calculated in each case from the first day of the last menstrual period. An intramuscular injection of I_{131} was given to each and the presence of this substance in the foetal thyroid was demonstrated.

The authors conclude that radio-active iodine should not be given to the mother after the fourth month of gestation.

Josephine Barnes

350. **Oxygen Saturation in the Umbilical Cord.**

By G. ROOTH and S. SJÖSTEDT. *Acta obstet. gynec. scand.*, 34, 442–452. 1955. 3 figs. 27 refs. [In English.]

This is a study, undertaken at Lund University, Sweden, of the oxygen saturation of the blood in the umbilical vessels immediately after birth of the child.

The average saturation in 98 spontaneous normal deliveries was 61 per cent in the vein, and 33 per cent in the arteries. In 34 cases of asphyxia the corresponding figures were 39 and 16 per cent.

When inhalation anaesthesia was given to the mother and Caesarean section was performed (22 cases) the oxygen saturation was almost as low as in the asphyxiated children (42 and 20 per cent respectively), but if Caesarean section was performed under local anaesthesia (11 cases) the oxygen saturation was only slightly lower than that found with spontaneous normal deliveries.

Short ether anaesthesia for forceps delivery, done for indications other than foetal distress, did not affect the oxygen saturation of the blood in the umbilical vessels.

N. Alders

351. **Is Premature Birth Preventable?**

By H. L. TIECHE, C. D. OSBORN and J. A. BROMAN. *Obstet. Gynec.*, 7, 496–502. May 1956. 2 figs. 5 tables. 28 refs.

The birth weights of 1,683 consecutive single liveborn infants were determined by the authors. The birth weights produced a normal distribution curve with an incidence of prematurity of 8·26 per cent. Premature rupture of the membranes may have produced 15 of the premature births, toxaemia 3 and ante-partum haemorrhage 10, a total of 20 per cent. The authors point out the fallacy in accepting these complications as causes of premature labour. In most cases premature birth is probably not preventable.

J. G. Dumoulin

352. **Radiological Assessment of Postmaturity.** (Valutazione clinico-radiologica dei nati da gravidanza protratta.)

By G. COLLA and A. TETTI. *Minerva Ginec., Torino*, 8, 249–261. Mar. 31, 1956. 5 tables. 4 plates. 36 refs.

Assuming that the occasional occurrence of postmaturity is a reality and that it carries a risk to the foetus, the authors have endeavoured to assist the clinician to diagnose these cases by radiological means. It is recognized that abnormally great weight and length can be hereditary and not due to postmaturity in some cases. Other categories considered are: (1) hypermatures, showing general signs of development (nails, skin, ossification, general appearance) comparable to those of

babies some weeks old; (2) overtime babies, apparently normal full-term babies but by calculation carried beyond 280 days due perhaps to late nidation or to a slower process of development for unexplained reasons; and (3) postmatures, showing adverse effects of commencing placental insufficiency.

Fifty babies, 25 males and 25 females, carried for a calculated period of 294 days or more were investigated. The centres of ossification in the femoral and tibial epiphyses at the knee, cuboid, medial humeral epiphysis, os magnum, uncinate, and coracoid process were studied radiologically on the day after birth (in both limbs). After considering the measurement of all these centres, together with the weight and length of each baby and with the excess number of days carried beyond 280, the infants were classified into one of the four groups detailed above. Two tables of results are given, one for males and one for females. The authors conclude that it is essential to take into account several of these centres and not merely one in forming an opinion as to the relative maturity of any given foetus. It is, however, very doubtful if X-rays taken of a foetus *in utero* could possibly give comparable exactitude as to the presence of the various centres, much less as to their size. The tables and X-rays are none the less very interesting and instructive.

W. C. Spackman

353. **Cortisone Therapy in Early Pregnancy: Relation to Cleft Palate.**

By J. W. S. Harris and I. P. Ross. *Lancet*, **1**, 1045–1047. June 30, 1956. 2 figs. 13 refs.

The authors report the occurrence of a cleft palate in a baby whose mother received cortisone therapy in early pregnancy for idiopathic steatorrhoea. She was given a daily dose of 300 mg. cortisone which was reduced over a period of nearly 4 weeks to 25 mg. per day, and this dose was maintained for a further five weeks or so. The administration occurred from the time the foetus was approximately 38 days old, which is just prior to the time when the palatal processes are appearing to produce the palate. The authors point out that while there is no justification for attributing the cleft palate to the administration of cortisone to the mother in early pregnancy it is reasonable to draw attention to the similarity between experimental findings in animals and the present case. They conclude that it is desirable to exclude the possibility of early pregnancy before administering cortisone to women.

H. H. Fouracre Barns

354. **Perinatal Mortality.**

By L. G. R. van Dongen. *S. Afr. med. J.*, **30**, 399–403. Apr. 28, 1956. 1 fig. 2 refs.

Many factors other than the purely obstetric are involved in the problem of stillbirths. Age, parity, rapid succession of pregnancies, adequate nutrition and general social factors all influence foetal loss. A dramatic decline in the number of stillbirths took place between 1939 and 1945. In spite of the war, essential foodstuffs were rationed, antenatal clinics were well organized and Caesarean section became a safer procedure with the extended use of blood transfusion and antibiotics.

The author has analyzed the stillbirth and neonatal death rates at the Queen Victoria Hospital, Johannesburg, for the years 1952, 1953 and 1954. There has been a steady improvement over the 3 years, due perhaps to more diligent antenatal supervision and the freer use of Caesarean section in cases of placenta praevia and foetal distress in the first stage. The perinatal mortality is considered in the 3 natural divisions: macerated stillbirths, fresh stillbirths and neonatal deaths.

Macerated stillbirths

This occurred much more frequently in mothers over 30 years old. It was twice as common in multiparae as in primiparae. In about 50 per cent of cases the cause was unexplained. Pre-eclampsia accounted for 14·5 per cent, and in a further 8·5 per cent the placenta was grossly infarcted. Another 4·3 per cent were associated with accidental haemorrhage. Chronic nephritis and diabetes each accounted for 0·9 per cent and rhesus antibodies for as many as 12·8 per cent. of the macerated stillbirths. Umbilical cord anomalies were found in 6 per cent and 2·6 per cent had gross congenital abnormalities.

This group included 117 cases.

Fresh stillbirths

Once again the incidence was greater after the age of 30 years. In those over 40 years old it was 5 times the average. The incidence was also greater in multiparae.

The author considers:

(*a*) Conditions associated with pregnancy, which were responsible for 41·2 per cent of the stillbirths (pre-eclampsia 11·3 per cent, accidental haemorrhage 15·5 per cent, placenta praevia 7·2 per cent, hydrops foetalis 3·1 per cent, and syphilis, chronic nephritis, external version and premature rupture of membranes for the remainder).

(*b*) Conditions associated with labour were responsible for 32·9 per cent of the deaths (accidents to the cord 11·3 per cent, difficulty in delivering the aftercoming head 4·1 per cent, foetal distress 8·2 per cent, internal version 4·1 per cent, cerebral haemorrhage 2·1 per cent, and rupture of the uterus 3·1 per cent).

(*c*) Gross congenital abnormalities caused 10·3 per cent of the fresh stillbirths, and the cause was unknown in 15·5 per cent of cases.

This group included 97 cases.

Neonatal deaths

In this group maternal age was of less significance. Seventy-five per cent of the babies were premature, and there was a slight preponderance of males. Sixty per cent of the neonatal deaths occurred in the first 24 hours.

The chief causes were prematurity 46·6 per cent, atelectasis 19·0 per cent, gross congenital abnormalities 10·9 per cent, cerebral haemorrhage 8·7 per cent, rhesus antibodies 4·4 per cent and prematurity associated with pre-eclampsia in 4·9 per cent.

The author states that perinatal mortality is a challenge to be met in a diversity of ways. Basically it is concerned

with the health of the nation. More specifically it requires expert antenatal supervision and adequate facilities for dealing with abnormalities as they arise.

L. J. Abramowitz

GYNAECOLOGY

355. **The Problem of Intersex.**

By R. HOFFENBERG and W. P. U. JACKSON. *S. Afr. med. J.*, **30**, 417–422. May 5, 1956. 6 figs. 24 refs.

The authors state that diagnostic techniques and methods of management have improved in recent years. Early correct diagnosis is essential if later tragedy is to be avoided.

True hermaphrodites are rare. Only about 60 cases have been reported in the literature.

There are two forms of female pseudo-hermaphrodite. The vast majority are due to intra-uterine adrenocortical over-activity. Urinary 17-ketosteroids are invariably high, and response to early cortisone therapy is excellent. A much more rare variety with normal 17-ketosteroids may be distinguishable only at exploratory laparotomy. In both these types reproduction is possible.

Male pseudo-hermaphroditism exists in several different degrees. It would seem that this would depend on the stage of intra-uterine development at which the male gonad is damaged, or ceases to exert its influence. In a very rare group the testes actually produce oestrogens, and the patients may have completely normal female genital appearance.

Two cases are reported. The first, considered to be a female at 14 years, had a fairly large phallus amputated and a gonad was removed from the left labio-scrotal fold. Puberty commenced along masculine lines and she was given oestrogens. At 27 years on psychological appraisal she was found to have femininity of outlook. The earlier misdiagnosis forced upon her the choice of life as a male without a phallus or a bearded infantile female.

The second patient, raised as a female, had marked male orientation on psychological survey. There were striking masculine features, and the 17-ketosteroid excretion was 134 mg. in 24 hours. Cortisone in earlier years would have prevented this marked masculinity.

With regard to diagnosis, patients require careful examination of external genitalia, roentgenological visualization of any orifice in the phallus or perineum, 17-ketosteroid estimations, and if doubt still exists, laparotomy with bilateral gonadal biopsy. A great advance today is detection of genetic sex by skin biopsy.

It is a mistake to assume that the child must be raised in the sex corresponding to the gonads. For instance, the most extreme form of male pseudo-hermaphroditism si completely female in body build and external and internal genital development. In older patients the psychological outlook is most important in reaching a diagnosis. When the decision has been made, artificial devices may be employed to further development in the "chosen" sex, e.g., gonadectomy or hormonal therapy.

Nine aphorisms are mentioned.

L. J. Abramowitz

356. **The Bioassay of Follicle Stimulating Hormone by Augmentation with Human Chorionic Gonadotrophin. A Summary of Method and Results.**

By E. G. HOLMSTROM and H. A. SALHANIK. *West. J. Surg. Obstet. Gynec.*, **64**, 270–278. May 1956. 4 refs. 2 figs.

The authors, from the University of Utah, have evolved a method for estimating the amount of FSH in urine by using the ovary of the immature mouse and potentiating the action of the hormone by the concurrent administration of massive amounts of human chorionic gonadotrophin. This minimizes the effect of luteinizing hormone present in the urine. Using the method, the excretion of FSH has been studied during the menstrual cycle in 2 patients; decreases in excretion being found in the midfollicular and midluteal phases. It has been found in other patients that increased excretion occurs within 48 hours of castration and the method has been helpful in the investigation of different causes of amenorrhoea.

[No technical details of the method are given in this paper, which must be regarded as a preliminary report only.]

D. C. A. Bevis

357. **Post-menopausal Oestrogen Production.**

By R. A. STRUTHERS. *Brit. med. J.*, **1**, 1331–1335. June 9, 1956. 16 refs.

Investigations were carried out in order to (1) determine the number of women in whom post-menopausal oestrogenic activity was present; (2) attempt to make a quantitative estimation of that oestrogen; and (3) determine its source.

The presence or absence of oestrogen was determined by examination of vaginal smears, and, by grading the smears according to their cytological characteristics into four grades, a reasonably accurate assay of oestrogen was obtained. This form of assay is simple, cheap and quick. Other workers have shown the smear method to be as accurate as other methods of bioassay, and possible inaccuracy through using animals is eliminated.

Smears were obtained by stroking a spatula firmly down the upper third of the anterior wall of the vagina. They were fixed in equal parts of ether and absolute alcohol and stained by a method modified from that of Papanicolaou.

The smears were graded A, B, C, or D, according to the number and proportion of fully developed squames, navicular and parabasal cells present. Grade A smears (those made up of fully developed squames) were fully oestrogenic, while Grade D smears (composed almost entirely of parabasal cells) were completely non-oestrogenic. The majority were found to lie between these two extremes.

Of 110 women who had had a normal menopause 64 (58 per cent) showed a considerable amount of oestrogen activity, falling into Grades A (6 or 5·5 per cent) and B (58 or 52·7 per cent), and 29 (26·4 per cent) showed a little oestrogen activity (Grade C). Only 17 (15·5 per cent) of the smears showed that no oestrogen was present at all.

Very similar figures were obtained by studying 131 women following bilateral oöphorectomy and 112 women in whom the menopause was induced by radiotherapy. These results seem to indicate that it is exceptional for women to secrete no oestrogens after the menopause and that the oestrogen present is not ovarian in origin.

In a small series, smears were taken before and after adrenalectomy performed on patients who had already had their ovaries removed. There was no significant change in oestrogen level, hence the adrenals are not presumably the source of the oestrogen either. It is possible that the pituitary is the main site of post-menopausal oestrogen production.

Fifty-seven women with breast carcinoma and 67 with genital carcinoma were found to have no greater oestrogen production than normal women in similar groups according to age and mode of menopause. It seems unlikely therefore that oestrogens have an important part to play in the development of either breast or female genital tract cancer.

R. W. Grayburn

358. **The Glycogen Content of the Endometrium in Functional Metrorrhagia.** (Il glicogeno endometriale nelle metrorragie disfunzionali.)

By F. DEZZA. *Ann. Ostet. Ginec.*, **77**, 923–928. 1955. 5 figs. 26 refs.

The author has studied the glycogen content of the endometrium by means of a special staining method. This method is Gastaldi's modification of the method of MacManus Hotchkiss.

Study of the endometrium from 34 women with normal cycles showed that very little glycogen is present in the follicular phase, but that it appears in conspicuous quantities in the progestational phase of the menstrual cycle.

In 58 cases of functional metrorrhagia, glycogen was absent or present in very small amounts in 51·8 per cent; it was present in amounts corresponding to the normal follicular phase in 34·4 per cent and present in large quantities, though smaller than those normally seen in the progestational phase, in 13·8 per cent.

It is concluded that this indicates that the endometrium is very sensitive to progesterone even in very small quantities.

Josephine Barnes

359. **Comparative Morphological Studies of Endometrium and Vaginal Epithelium after X-Ray Castration.** (Vergleichende morphologische Untersuchungen am Endometrium und Vaginalepithel nach Röntgenkastration.)

By G. F. WINTER and P. PORS. *Arch. Gynäk.*, **187**, 282–304. 1955. 2 tables. 8 figs. 20 refs.

The endometria of 47 women aged 45 or over were studied after X-ray castration with a view to determining after what time interval atrophy became manifest. Only women with normal ovarian function before X-ray treatment, i.e., those suffering from fibroids or adenomyosis, were selected for this study. Endometrial biopsies and vaginal smears were taken at various intervals after castration. In the majority of cases there was a gradual decline of hormonal activity; the cycle following the castration dose was usually unaffected, then a resting and later an atrophic endometrium developed. The average interval between castration treatment and established resting endometrium was 42 days, and it took approximately another 30 days for atrophy to occur. These were average figures, but great individual variation was noticeable (55 days to 2 years).

Hormonal effects on the vaginal epithelium were studied by acidophilic and cornification indices. Both curves showed a gradual fall, but up to 60 days values regarded as the lowest normal for ovulatory cycles were still present. The authors correlate cornification values of 20–30 per cent. with a functioning endometrium, values between 10 and 20 per cent. with a resting and under 10 per cent with an atrophic endometrium. They regard their findings as corroborative evidence of Braun's work, which showed that radiation affects at first the young growing follicle and only later damages the fully mature follicles.

Erica Wachtel

360. **The Prophylaxis of Backache in Women.** (Prophylaxie de la lombalgie chez la femme.)

By E. SCHLEYER-SAUNDERS. *Gynéc. prat.*, **7**, 25–37. 1956. 8 figs. 2 refs.

Backache is so common amongst women that it is accepted as a necessary evil.

Backache is classified into three groups: (1) Gynaecological; (2) Orthopaedic; (3) Rheumatic.

There is considerable overlap of these categories. The commonest causes of backache are postural, and are often associated with changes in the lumbar lordosis. The relaxation of the pelvic ligaments occurring in pregnancy and the menstrual cycle may contribute to such changes.

Prophylaxis should start in childhood by careful attention to general health and posture. In pregnancy exercises should be performed and the diet should be adequate in Vitamin D and calcium. A maternity corset should be worn. The author believes that in the puerperium undue movements at the pelvic joints can be prevented by a belt and has designed one that is both simple and effective. He condemns symphysiotomy.

During both gynaecological and obstetrical operations, the lumbar curve should be supported and a similar support should be continued in the post-operative period. When the lithotomy position is to be adopted, the use of longer lithotomy posts affords adequate access to the field of operation without the extreme strain placed on the lumbar region by the normal posts.

Geoffrey Dixon

361. **Leukemic Infiltration of Female Genitalia: A Gynecologic Entity.**

By S. L. ISRAEL and J. C. MUTCH. *Obstet. Gynec.*, 7, 425–432. Apr. 1956. 6 figs. 1 table. 12 refs.

This report presents 3 cases in which abnormal uterine bleeding led to a diagnosis of leukaemia, and correlates

the clinical data and post-mortem findings in 7 additional leukaemic females studied at the Pennsylvania Hospital since 1939.

Eight of the 10 cases showed infiltration of genital tissues and these lesions sometimes mimic carcinoma. Five of the cases had abnormal uterine bleeding. Leukaemic infiltration of the ovaries has been known to cause amenorrhoea. Uterine bleeding may be due to leukaemic infiltration of the uterus, activation of a myomatous uterus, or associated splenic dysfunction. It is also possibly associated with defects in the clotting mechanism as a result of platelet deficiency.

J. G. Dumoulin

362. **Malformations of the Uterus as Revealed by Hysterography.** (Casistica isterografica di alcune malformazioni uterine.)

By E. FERRARIO. *Minerva ginec., Torino*, **8**, 119–131. Feb. 15, 1956. 6 tables. 22 figs. 41 refs.

A full classification of congenital abnormalities of the uterus is given, illustrated by sketches and hysterograms, and clinical histories. Certain varieties associated with recurrent abortion (infertility but not sterility) are amenable to treatment by metroplasty.

W. C. Spackman

INFECTIONS OF THE REPRODUCTIVE ORGANS

363. **Hydrocortisone in Vaginitis. Preliminary Report on Use of Hydrocortisone Vaginal Tablets.**

By M. ROLAND, E. C. VEPROVSKY and W. LINHART. *Obstet. Gynec.*, **7**, 459–461. Apr. 1956. 6 refs.

One hundred and twenty-seven patients with vaginal discharges of various types were treated with hydrocortisone vaginal tablets (10 mg. daily for 5 days). The results of treatment alone were frequently good, but they were even better when combined with specific therapy when there was a trichomonas or monilia infection.

J. G. Dumoulin

364. **Midvaginal pH. Is there a Significant Difference in pH in Trichomonad and Candidal Infections in Pregnant and Nonpregnant Women?**

By W. R. LANG, A. E. RAKOFF and H. MENDUKE. *Obstet. Gynec.*, **7**, 378–381. Apr. 1956. 2 figs. 14 refs.

Midvaginal pH was measured electrometrically with a single Beckman G pH meter in 599 patients attending the vaginitis clinic at Jefferson Medical College Hospital.

Pregnancy was associated with a pH 0·3 lower than in non-pregnant women. Monilial infection was associated with an elevation of 0·1 in pH. In infection with trichomonas the pH rose by 0·6. Mixed infection was associated with a pH between those of its components.

J. G. Dumoulin

NEW GROWTHS OF THE REPRODUCTIVE ORGANS

365. **Mixed Mesodermal Tumours of the Uterus.**

By M. THIERY and A. BRUNSCHWIG. *Acta obstet. gynec. scand.*, **34**, 301–344. 1955. 30 figs. 43 refs. [In English.]

The authors describe and discuss in detail 11 cases of mixed mesodermal tumours of the uterus which were observed at the Gynecological Service of Memorial Center, New York, between 1948 amd 1953. The growth originated in the body of the uterus in 8 cases, in the cervix in 2 cases, and in body and cervix once. The average age incidence was 60 years. These tumours produce no typical clinical symptoms. In most respects the symptoms resemble those of endometrial or cervical cancer. The physical signs, however, are somewhat more suggestive of their pathology, the commonest finding being a polypoid structure protruding through the cervical os.

Involvement of the pelvic lymph nodes is not a prominent feature of these growths, and remote metastases are rarely found. Radiation therapy has no place in the treatment of these tumours which should be attacked by radical surgery.

N. Alders

366. **The Use of the Fluorescent Microscope in the Cyto-Diagnosis of Uterine Carcinoma.** (La microscopia a fluorescenza per la citodiagnosi del carcinoma uterino.)

By L. D'INCERTI BONINI. *Ann. Ostet. Ginec.*, **77**, 929–949. 1955. 11 figs. (one in colour). 47 refs.

This is a description of the use of the fluorescent microscope in the examination of vaginal smears with a view to the early diagnosis of uterine carcinoma. The smears are stained with a special fluorescent stain. The malignant cells show up very clearly and it is believed that this method will prove particularly useful in those cases where diagnosis is difficult.

Josephine Barnes

367. **Photographing Tumors of the Uterine Canal in Patients.**

By W. B. NORMENT and C. H. SIKES. *J. Amer. med. Ass.*, **160**, 1014–1017. Mar. 24, 1956. 4 figs. 2 refs.

Practically all hollow viscera and apertures of the body have previously been photographed with the exception of the uterine canal. By using a water hysteroscope the authors have demonstrated the endometrium in its different phases during the menstrual cycle and various tumours of the uterine canal. The technique of photography through the Norment hysteroscope requires a continuous flow of water through the instrument and the lumen of the uterus to clear away bleeding, and this is interrupted momentarily for direct visualization and exposure to a suitable endoscopic camera. Colour film is especially valuable, and the appearance of tumours is entirely different from those seen after curetting or hysterectomy. It is suggested that this diagnostic method may prove to be more valuable than the usual procedure of curettage.

D. W. James

368. **"Accidental" (Unsuspected) Cancer of the Cervix.**

By M. S. ROSENBLATT and D. SMITH. *West. J. Surg. Obstet. Gynec.*, **64**, 352–354. June 1956. 3 figs. 5 refs.

Out of 190 cases of cervical carcinoma encountered

between 1946 and 1953, in 20 cases the disease was only found on examination of operation specimens in the laboratory. Eleven were invasive, the others being carcinoma *in situ*. A follow-up showed that 8 patients died of the disease, the remainder remaining free of extension in recurrence so far. The authors advocate routine curettage and more extensive biopsies in all patients who are going to be operated upon for "benign" conditions.

D. C. A. Bevis

369. **Original Site of Cervical Carcinoma. Topographical Relationship of Carcinoma of the Cervix to the External Os and to the Squamocolumnar Junction.**

By M. Marsh. *Obstet. Gynec.*, 7, 444–452. Apr. 1956. 2 tables. 4 figs. 40 refs.

A total of 454 malignant neoplasms of the cervix were studied, including 83 in which the entire cervix was available. In the 83 complete cervices the carcinoma was found on the exocervical side of the external os in 2 cases, on the endocervical side in 42, on both sides in 11, and was not determinable in 28 cases.

After a thorough review of the literature on the site of origin of cervical carcinoma the author points out the marked frequency with which the carcinoma in this series was found to start on the columnar side of the squamo-columnar junction in the endocervical canal.

The implications are important. Biopsy studies of the cervix should include tissue from the columnar side of the junction and from the endocervical canal.

J. G. Dumoulin

370. **Carcinoma In Situ of the Uterine Cervix.**

By L. E. Lee, P. J. Meinick and H. M. Walsh. *Surg. Gynec. Obstet.*, **102**, 677–682. June 1956. 5 figs. 10 refs.

This report from Puerto Rico represents part of a 5-year programme of clinical, cytological and histological study and follow-up of carcinoma of the cervix in a large and uniform population. The 8,500 women screened by pelvic and cytological examination represent a cross-section of adult women from the general population who were not under medical observation for pelvic symptoms or disease.

An abnormal smear was found in 37·5 per cent, 33·1 per cent of all cases had an abnormal cytological pattern not regarded as cancer, 3·3 per cent of all cases were found to be suspicious of cancer, 0·51 per cent were regarded as carcinoma *in situ* and 0·63 per cent were reported as carcinoma.

In all suspicious cases biopsies were made; 584 patients were subjected to one or more biopsies of the cervix and in 461 of these, no malignant condition was observed. Thus, by combining clinical, cytological and histological means of study, in 98·7 per cent of the total number screened no malignant condition was noted.

Sixty-seven cases of carcinoma *in situ* were proved histologically, a frequency of 0·79 per cent of the entire series. Smears have been repeated monthly and biopsies have been made at 6-monthly intervals. Fifty-three of these patients have been followed for as long as 3 years and in none has the carcinoma become invasive while under observation. In addition, 56 invasive malignant tumours were found or 0·67 per cent of all patients screened.

A study was also made of the cases of carcinoma *in situ* which were found in the course of a review of the histological sections of 811 cases of carcinoma of the cervix encountered between 1932 and 1955. Sixteen cases of endocervical neoplasms were found in which the portio vaginalis was observed to be the site of carcinoma *in situ*. In all the associated carcinoma *in situ* was found separate from the endocervical neoplasm.

These cases suggest that the occurrence of carcinoma *in situ* reflects a tendency of the involved cervix as a whole to develop neoplasms. This concept is further supported by 10 additional cases of carcinoma *in situ* adjacent to carcinomas of the portio whose histological patterns were distinctly different and, therefore, not the result of invasion and spread along the surface of the carcinoma.

John P. Erskine

371. **The Use of Clinical Methods of Investigation in the Prevention of Cervical Cancer.** (Die klinischen Untersuchungsmethoden im Dienst der Prophyllaxe des Portiocarcinoms.)

By Prof. Dr. Hinselmann. Reprinted from *Schleswig-Holstein. Ärztebl.*, No. 1. 1956. 4 pp. 3 figs.

At present there are three methods of investigation in use for the recognition of early cervical cancer: Colposcopy, first described in 1924; Schiller's iodine test, introduced into gynaecology in 1927; and exfoliative cytology, advocated by Papanicolaou and Traut in 1943.

Colposcopy and the iodine test are capable of showing up gross histological changes. Colposcopy allows a detailed view of the epithelial surface and the iodine test gives information on the glycogen content of the epithelium and the permeability of its superficial layers. Colposcopy was further developed into colpomicroscopy by Antoine, allowing a magnification of 175 to 280 times as compared to the maximum magnifying power of 80 times of the colposcope. Furthermore, by pulling the cervix down for direct examination under the ultrapak microscope, magnifications up to 960 and even 1,200 times can be achieved. This method can be further improved in two ways: (1) by using the Papanicolaou stain, and (2) by vigorously wiping the cervical surface and thus exposing deeper epithelial layers for inspection. The wiped off material is spread on a slide and also examined under the microscope. Colposcopy has an additional use in the examination of operation specimens to determine the extent of the lesion and the depth of infiltration.

Professor Hinselmann stresses the importance of the practitioner carrying out these examinations himself, of being familiar with these new methods, and of realizing their role in cancer prevention.

Erica Wachtel

372. **The Early Diagnosis of Carcinoma of the Cervix by Modern Methods.** (Le dépistage précoce du cancer du col utérin par les méthodes modernes. Etude critique des diverses techniques à l'attention du practicien.)

By J. P. PUNDEL and F. SCHWACHTGEN. *Gynéc. prat.*, 7, 7–24. 1956. 29 refs.

This article is an evaluation of the place of vaginal cytology in the diagnosis of cervical malignancy in its earlier stages.

Cytology is more accurate than Schiller's test or colposcopy. (In a series of 174 cervical carcinomata that they have seen, the authors have had only 2 cases in which vaginal cytology was negative.) The authors consider that smears should be taken by Ayre's method and not simply from the posterior fornix.

They insist, however, that a positive smear alone is insufficient to justify treatment, but must be confirmed by biopsy. A negative smear must not be accepted if any other clinical test or the clinical picture suggests malignancy. There is a great place for cytology in the follow up of the clinically suspect case with negative or doubtful histology, but for the method to be of value the cytologist must be competent and the clinician versed in the principles of cytology as well as the technique of smear-taking.

In carcinoma *in situ*, the problem is not only of diagnosis, but of treatment, and the authors now place such reliance on cytology that they use the method to follow any lesion detected on Schiller's test or colposcopy. If the smears remain negative they employ only simple electro-coagulation.

When a biopsy has been taken and the histology is dubious, the cervix should be amputated and serial sections taken. The case is then followed by vaginal cytology.

The authors consider that although the place of vaginal cytology is large, the difficulties of interpretation and the small numbers of expert cytologists available make it a method only to be used in large centres and not by the individual practitioner.

Geoffrey Dixon

373. **Primary Carcinoma of the Ovary.**

By B. A. DAVIS, J. P. A. LATOUR and N. W. PHILPOTT. *Surg. Gynec. Obstet.*, **102**, 565–573. May 1956. 18 figs. 18 refs.

This series consists of 270 cases of primary carcinoma of the ovary seen at the Royal Victoria Hospital, Montreal, during the years 1930 to 1954. No case was included unless surgery was performed or a post-mortem examination done.

The average age was 49·9 years with 62·6 per cent of the patients in the age range from 40 to 59 years. 78·9 per cent were married and the infertility rate of 20·6 per cent was almost identical with that of the general population. Abdominal pain and swelling were the most common symptoms.

Clinical staging based on operative findings was carried out. This bore very little correlation to the type or duration of the symptoms or the age of the patient, but there was some relationship to the histological grading. 95·3 per cent of the cases were either serous or pseudomucinous adenocarcinomas.

In 15 cases previous abdominal surgery had been performed for benign diseases of the internal genitalia. In 5 instances at the time of operation the patient was aged 44 or more and in these, carcinoma of the ovary could have been prevented by a more radical approach.

The authors advocate total hysterectomy and bilateral salpingo-oöphorectomy as the optimum surgical procedure. In addition to surgery 27·7 per cent of patients received X-ray therapy.

The overall 5-year survival rate was 37·6 per cent. There was a close correlation between the survival rates and clinical stages. Additional radiotherapy did not appear to have an appreciable effect on prolonging life and no relationship was found between histological type and radio-sensitivity.

John P. Erskine

374. **Carcinoma of the Endometrium. Survey of Treatment and End Results in a Community Hospital.**

By F. B. NUGENT and J. E. GLEICHERT. *Obstet. Gynec.*, 7, 406–411. Apr. 1956. 5 tables. 8 refs.

During the 14 years 1936–1949, 105 women were admitted to the Reading Hospital, Pennsylvania, with carcinoma of the corpus uteri and 223 with carcinoma of the cervix. During the first 5 years the ratio of corpus to cervix growths was 1 : 6; during the last 5 years it was 1 : 1·6. The incidence of cervical carcinoma remained static, whilst that of corpus carcinoma increased.

The outstanding characteristic of women who develop carcinoma of the endometrium is obesity. The relationship of a diabetic tendency is significant. The average age of the group was 55·2 years, and the average age of the menopause in the post-menopausal group was 49·6 years. Twelve per cent of the series were unmarried. Eight cases (7·6 per cent) had received irradiation for benign disease prior to the development of carcinoma. Fifty of the 105 cases had coexisting fibroids. There was a history of endometrial hyperplasia in 22 per cent.

Three methods of treatment were used—hysterectomy alone, hysterectomy preceded by intra-cavity radium, and radiotherapy alone. Examination of uteri removed after radium treatment showed a persistence of growth in 72·3 per cent.

Of the 105 cases, 68 lived for more than 5 years without evidence of recurrence. Thirty-one died from cancer and 6 from some other cause.

J. G. Dumoulin

375. **The Pathogenesis of Endometriosis.**

By G. LEVANDER and P. NORMANN. *Acta obstet. gynec. scand.*, **34**, 366–398. 1955. 18 figs. 22 refs. [In English.]

The embryonic theories have been increasingly abandoned as explanations for the appearance of ectopic endometrium because of the difficulty in demonstrating embryonic deposits at all the sites in the body where endometriosis may occur. The most acceptable of the existing hypotheses is Sampson's implantation theory.

However, critical experimental examination of this theory has provided no convincing proof that living endometrial cells can survive transplantation and continue to grow in a foreign environment. One of the authors of this paper, G. Levander of Köping, Sweden, has brought forward an "induction theory" according to which chemical substances or small particles in the endometrium can be liberated from the cells, pass by the blood or lymph stream into a new environment, and there activate an omnipotent blastema to formation of endometrium. These specific substances are comparable to the "embryonic inductors" or "organizers" postulated by Spemann in his theory of epigenesis.

The present paper describes implantation experiments, in which pieces of whole uterine wall from rabbits in the last stages of pregnancy were transplanted into the subcutaneous tissues of either the mother rabbit (autologous implantation) or of other young female rabbits (homologous implantation). Part of the transplanted tissue was fresh and untreated, part was denatured by trypan blue.

[The details of the authors' technique, of the histological examination of the transplants at various intervals, and of the discussion of their findings do not lend themselves for short abstracting, but the beautifully illustrated paper makes interesting reading.]

The authors arrive at the conclusion that the cells of the implants, at their death, give out specific substances which activate still undifferentiated tissue in a specific direction, namely, to the formation of endometrium. They state that their induction theory provides "a fully adequate explanation for all experimental and clinical observations".

N. Alders

376. **Treatment of External Endometriosis.**

By C. M. MALONE. *West. J. Surg. Obstet. Gynec.*, **64**, 243–246. May 1956. 5 refs.

A review of 237 cases of external endometriosis (in which all the endometrial growth is located outside the uterus) is presented; the diagnosis being confirmed by operation in 82. The surest prophylactic against endometriosis is pregnancy and the author advocates early marriage and emphasizes the need for the correction of any abnormality which might prevent conception, particularly retroversion of the uterus, obstruction of the cervix from any cause and the removal of fibroids if present. In established cases sedatives should be combined with the administration of amphetamine or similar "mood elevator". Methylandrosterone in 10 mg. doses sublingually as required may be helpful in suppressing ovarian function and allowing fibrosis to occur. Irradiation may help some patients but it cannot free adhesions. Surgery should be conservative if possible, and presacral neurectomy is useful for dysmenorrhoea. If the patient has completed her family or is in the older age groups, radical surgery is indicated, but it is as well to remember that the cervical stump can be removed vaginally if there are dense adhesions in the pouch of Douglas which make total hysterectomy dangerous; a subtotal operation is best in these cases.

D. C. A. Bevis

377. **Stromal Endometriosis.**

By M. A. SCHIFFER and A. MACKLES. *Obstet. Gynec.*, **7**, 531–539. May 1956. 12 figs. 18 refs.

The authors describe in detail 2 cases of stromal endometriosis, a condition which some pathologists mistake for sarcoma. Although the histological appearance is benign, metastases and recurrences have been reported so that the condition should be considered of low grade malignancy. The uterine mass is usually thought at first to be due to fibroids but the diagnosis can be made at operation by the appearance of an enlarged uterus with extension of worm-like masses into the vessels of the broad ligaments.

J. G. Dumoulin

378. **Problems in the Diagnosis of Adenomyosis Uteri, with Special Reference to Dysfunctional Bleeding.**

By L. A. EMGE. *West. J. Surg. Obstet. Gynec.*, **64**, 291–304. June 1956. 9 refs.

The author presents his views on the diagnosis of this condition from the histories of 264 patients with internal endometriosis. One hundred and forty-seven had symptoms which seemed sufficiently characteristic to warrant a clinical diagnosis, but 52 were rejected by the pathologist, while 117 had pathological changes which were minimal or overlaid by other conditions (fibroids, carcinoma, ovarian neoplasms, etc.). The traditional triad of symptoms, increasing menorrhagia, a steadily enlarging uterus of unusually firm consistency, and dysmenorrhoea of long standing are considered to be basic in making the clinical diagnosis, but are subject to wide variation in severity. One hundred and eleven patients out of 212 had dysfunctional bleeding (which is considered to be due to interference with the myometrial control of the vessels rather than bleeding from the aberrant endometrial rests), but as the adenomyosis was associated with fibroids and polypi in a large proportion of cases its use as a sign is limited. Slightly less than half the cases had dysmenorrhoea, but if uncomplicated cases alone are considered the ratio falls to one quarter. The author concludes that the condition is not as readily diagnosed as is usually taught.

D. C. A. Bevis

OPERATIONS

379. **Culdoscopy: a New and Telescopic Method of Inspecting the Pelvic Organs: A Review of 162 Patients.**

By A. GRANT. *Med. J. Aust.*, **1**, 834–836. May 19, 1956. 2 tables. 14 refs.

With a culdoscope the earliest signs of disease in the female pelvic organs can be seen before it can be felt or found by other means. It is particularly useful for the investigation of sterility. Rubin has said that in 20 per cent of cases of sterility no cause can be found. The author contends that the use of the culdoscope will greatly decrease this percentage, as well as revealing in which patients tubal lesions causing sterility may be benefited by operation.

The indications for culdoscopy are early endometriosis, unruptured ectopic gestation, "unexplained" causes of

sterility, prior to tubal plastic operations, pelvic pain with negative pelvic findings, and functional amenorrhoea. The gynaecological contra-indication is a fixed mass in the posterior fornix. The technique of culdoscopy described uses the knee chest position, so ankylosed joints or respiratory disease are other contra-indications.

The complications encountered in 162 patients were technical failures in 5 cases, surgical emphysema 1 case, secondary haemorrhage 1 case, thrombophlebitis of a vein in the hand following intravenous anaesthesia 1 case.

In 42 patients with "unexplained" sterility, disease was found in 30. Seven patients underwent culdoscopy for "possible ectopic gestation". In one of these the diagnosis was confirmed.

Grant states that culdoscopy is safer, quicker, cheaper and less damaging than exploratory operation.

S. Devenish Meares

380. **Vagino-Abdominal Approach in Pelvic-Cancer Surgery.**

By R. J. Simmons. *Obstet. Gynec.*, **7**, 527–530. May 1956. 2 figs. 10 refs.

In radical pelvic surgery for carcinoma the author suggests that a vaginal cuff be dissected prior to opening the abdomen. A circular incision is made around the vaginal wall at the selected level, if necessary at the introitus. Dissection is carried upwards around the vagina in a lateral plane within the paravesical space on each side up to the level of the parametrium. The bladder and urethra are then separated, followed by the rectum in the rectovaginal space. The vagina is thus mobilized as a cylindrical structure, and a gauze pack is inserted. The vaginal cuff is closed. The abdominal phase is then begun in the usual way.

In this way, certain advantages of the Schauta radical vaginal operation are utilized to improve the efficiency of the abdominal approach.

J. G. Dumoulin

381. **Hysterectomy: Analysis of 1,000 Consecutive Operations.**

By W. F. Watts and R. A. Kimbrough, Jr. *Obstet. Gynec.*, **7**, 483–498. May 1956. 15 tables. 11 refs.

The authors present an analysis of 1,000 consecutive hysterectomies performed at the Pennsylvania Hospital for benign conditions between 1951 and 1954. There were 692 total and 58 subtotal abdominal operations, and 250 vaginal operations. In 90 per cent of the cases, the patients' age was between 31 and 60. Abnormal menstrual bleeding was the commonest indication (43 per cent), followed by abdominal pain (17 per cent), prolapse (12 per cent) and pressure symptoms of fibroids (10 per cent).

There was one death in the series. The febrile morbidity rate was 20 per cent. In 592 patients some form of systemic chemotherapeutic or antibiotic agent was used. In 342 cases the appendix was also removed and in 559 there was partial or complete removal of adnexa. The average stay in hospital was 10–12 days.

In 415 patients fibroids were found alone. In 915 others fibroids with additional pathological conditions were present. An attempt was made to determine the justification for, or therapeutic necessity of, these 1,000 operations. Hysterectomy was considered unjustified in 3·4 per cent, and was criticized in 0·9 per cent because of failure to perform prior curettage for diagnosis and/or therapy.

J. G. Dumoulin

382. **Hysterectomy in Young Women.**

By W. M. Jacobs and H. I. Daily. *Surg. Gynec. Obstet.*, **102**, 539–542. May 1956. 3 figs. 4 refs.

This article consists of a review from the clinical and pathological standpoint of the hysterectomies done on women, 30 years of age and younger, on the gynaecological service of the Baylor University College of Medicine and the Jefferson Davis Hospital, Houston, Texas, for the period 1st January, 1953, to 30th June, 1955. The total number of hysterectomies performed during this period was 558 and of these 68, or 12·1 per cent were done on women of 30 years of age and younger.

In the group under review 22 were nulliparae, 8 were primiparae and the rest multiparae. Of the 22 patients who had never been pregnant, 20 were operated on for recurrent inflammatory disease and 2 were operated on for large myomas. The operation consisted of total abdominal hysterectomy in 45, vaginal hysterectomy in 20 and subtotal hysterectomy in 3 cases. In 23 cases both ovaries were removed.

The indications for operation are listed, the most common being as follows:

Severe recurrent pelvic inflammatory disease	20
Simple myomata	18
Prolapse, cystocele, rectocele	13
Carcinoma *in situ* (cervix)	6

It is considered that patients with recurrent inflammatory disease should either be treated by medical means, or when surgery is done it should consist of total hysterectomy and bilateral salpingo-oöphorectomy. In the rare case in which there is an inflammatory mass limited to one adnexal region and the other tube is patent, unilateral salpingo-oöphorectomy can be performed. In the past, incomplete operations such as bilateral salpingectomy or partial removal of inflammatory masses, have yielded discouraging results, and only necessitated reoperation at a later date.

Young women with symptomatic myomata could often be handled by multiple myomectomy, but 18 cases were deemed unsuitable for this operation and were treated by hysterectomy.

The authors believe that vaginal hysterectomy and repair constitute the best treatment for prolapse or cystocele or rectocele. They rarely employ the Manchester procedure. If the patient desires more children she is advised to complete her family and then have the operation performed.

Of the 6 cases of carcinoma *in situ* no invasion was found in the knife conization, and in the removed surgical specimen no evidence of carcinoma *in situ* was

found. It is suggested that perhaps a more conservative approach might have been used.

A long-term follow-up of these patients is now in progress and an evaluation of the final results from a physical and psychological standpoint will be of great interest.

John P. Erskine

383. **Postoperative Staphylococcic Enterocolitis after Antibiotic Therapy: Shock and Oliguria after Hysterectomy; Report of a Case with Recovery.**

By J. A. WALL and J. R. KELSEY, JR. *Obstet. Gynec.*, 7, 547–551. May 1956. 1 fig. 19 refs.

A patient underwent hysterectomy with removal of adnexa and appendicectomy for bilateral purulent hydrosalpinx. *Staphylococcus aureus* was cultured from the pus. Penicillin and streptomycin had been given for 5 days, the treatment finishing 15 days before the operation. Seventy-two hours after the operation there was a sudden onset of abdominal pain, vomiting and severe watery diarrhoea followed by shock. Faecal smears showed staphylococci. Treatment included erythromycin, chloromycetin and hydrocortone. Intravenous nor-adrenaline and fluid was given. Oliguria developed, but the patient gradually improved and recovered.

The authors point out that an overwhelming infection of this nature may result from alteration of the bacterial flora in the intestinal tract as a result of using antibiotics. Treatment should include pressor drugs such as noradrenaline, adrenocortical steroids as well as the appropriate antibiotic.

J. G. Dumoulin

384. **Node Dissection in Cancer of the Endometrium.**

By H. LEFEVRE. *Surg. Gynec. Obstet.*, **102**, 649–656. June 1956. 3 figs. 16 refs.

In the past it has been widely held that carcinoma of the body of the uterus metastasizes primarily to the aortic lymph nodes and that pelvic node involvement is rare and usually only a terminal phenomenon. For this reason surgical treatment has not generally included excision of the pelvic lymph nodes. In 1953 at the Bispebjerg Hospital, Copenhagen, it was decided to perform systemic dissection of the pelvic lymph nodes in all patients with cancer of the corpus uteri. This article consists of a report of the experience gained during the first 2 years.

The series consists of 45 patients with cancer of the uterine body, ranging in age from 35 to 73 years. Total hysterectomy and bilateral salpingo-oöphorectomy combined with dissection of the fatty and lymphatic tissue along the great vessels and in the obturator fossa was performed in 41 cases and the extended Wertheim operation in 4. Four of the operations were performed for recurrences following combined radium and X-ray therapy. There was no primary mortality and no serious morbidity.

In all 45 cases the diagnosis was made histologically following pre-operative curettage. Pelvic node involvement was found in 7 (16 per cent). In 5 of these the tumour was extensive, whereas in 2 uteri there was no macroscopic sign of tumour. (Both of these were from patients previously treated with radium and X-rays.) Metastases occurred primarily in those cases in which spread of the tumour had involved the juxta-cervical part of the uterine cavity. Moreover, in 6 cases of pelvic node involvement there was invasion of the myometrium. In one instance a tumour of a uterine horn had metastasized to the lymph nodes of the obturator fossa, which demonstrates that a juxta-cervical situation is not invariable in these cases.

If the carcinoma of the body involves the pelvic lymph nodes as often as indicated by these investigations, at first sight it would seem appropriate to extend the traditional operative intervention to include also dissection of the fatty tissue, connective tissue and lymphatic tissue of the pelvis, just as in the extended Wertheim procedure. It should be kept in mind, however, that any series of patients with carcinoma of the corpus uteri is bound to include a large number who are poor surgical risks. Thus the author recommends the extended Wertheim procedure only in suitable cases. In all other cases intervention should be restricted to the classical operation with or without bilateral dissection of the pelvic lymph nodes.

Owing to the short follow-up periods, the present series does not afford information as to prognosis.

John P. Erskine

385. **Peritonisation of the Cornu After Adnexal Extirpation.** (La péritonisation de la corne utérine après exérèse annexielle.)

By G. A. AIMES and P. FRANCHEBOIS. *Gynéc. prat.*, 7, 39–49. 1956. 5 figs. 32 refs.

Post-operative adhesion formation due to imperfect peritonization is common after gynaecological procedures. Owing to improved anaesthetic technique it is now possible to devote more time to this step. Peritonization is often particularly poor after removal of a tube with or without the ovary. The authors review the more widely known methods of covering the stump on the cornual angle. In cases of difficulty they advocate an elliptical excision of the intramural portion of the tube. The resultant wound is sutured longitudinally.

Geoffrey Dixon

386. **A New Operation for the Construction of an Artificial Fallopian Tube.**

By R. G. CROSS and C. A. ERSKINE. *Lancet*, **1**, 777–778. May 26, 1956. 4 figs. 8 refs.

The procedure consists of making an opening into the uterus, lining the opening with peritoneum, and utilizing the round ligament and local peritoneal tissue in the construction of the tube around a cord of polyethylene cord, which is left *in situ* for 90 days. The operation is based on the fact that the ovarian germinal epithelium, uterine tube and peritoneum have their origin in the coelomic epithelium. It is stated that the uterus and round ligaments undergo contractions at ovulation. The authors presume that at ovulation and

at subsequent fertilization muscular contractions of these structures continue whether or not a Fallopian tube is present, and help to transport the ovum to the uterine cavity. [If such is not the case, then the danger of ectopic pregnancy must be borne in mind.]

H. H. Fouracre Barns

387. **Oöphorectomy and Cardiovascular Tissues.**
By G. C. GRIFFITH. *Obstet. Gynec.*, 7, 479–482. May 1956. 10 refs.

Ovarian cancer strikes down one woman in every 100 past the age of 40, an argument used by some to suggest prophylactic removal of the ovaries whenever the opportunity presents. The author believes that the ovaries regulate metabolism; for example, castration is often followed by menopausal osteo-arthritis and decalcification of bony tissue. In the presence of impaired pancreatic activity, ovarian hormones protect against diabetes. Ovarian hormones confer relative immunity to atherosclerosis, especially coronary atherosclerosis. When hypertension follows removal of the ovaries, it usually is an expression of a disturbance in extracellular fluid balance. Oöphorectomy rarely initiates hypertension in the previously normotensive individual, but hypertension already present before removal of the ovaries is often accentuated by climacteric symptoms. There is a close interrelation of the various endocrine glands; the removal of one may cause profound changes in the structure and activity of every remaining member.

The ovaries should not be removed except for the most cogent of reasons.

J. G. Dumoulin

388. **Surgical Treatment of Vesico-Vaginal Fistulae.** (Хирургическое лечение пузырно-влагалищных свищей.)
By V. S. FRINOVSKII and L. K. SAVITSKAYA. *Akush. Ginec.*, No. 1, 46–50. Jan./Feb. 1956.

Fenomenov in 1896 laid down two fundamental principles for repair of vesico-vaginal fistulae: (1) the quantity of tissue in the operative field should be the same before and after the operation—as in plastic operations in which success is brought about by a transference of tissue without loss; (2) freshening-up should be carried out in such a way that firstly, suturing can be done without tension on the edges, and secondly, that the structures brought together should consist of anatomically analogous tissues.

These principles still hold good, and in the present series of 46 cases have been faithfully applied. Tissues have been split without excision, which last is superfluous, unnecessary and leads to loss of tissue. Mobilization and freeing of scar tissue on the wall of the bladder and correct alignment of sutures is the secret of success in such operations.

In some cases in which an artificial ureter has had to be formed, it is possible to utilize not only vaginal mucosa, but also neighbouring tissues such as the cervix uteri and the labia minora. For closing wide defects it is sometimes necessary to utilize tissue from the external genital organs and skin. For sphincter defects it is not essential to carry out a special muscle-plastic operation, since analogous function can be fulfilled by the trigone of the bladder.

These operations are best deferred for at least 3 months after fistula formation, when atrophic scar tissue has developed. After repair, childbirth *per vias naturales* should be forbidden, and if a woman of child-bearing age is unwilling to agree to Caesarean section in all future pregnancies, she should be sterilized.

Out of the 46 cases, 33 were completely successful, 8 temporarily relieved, and 5 unsuccessful.

L. Firman-Edwards

UROLOGY

389. **Carcinoma of the Female Urethra.**
By A. L. DEAN. *J. Urol.*, 75, 505–513. Mar. 1956.

The proximal part of the urethra is lined by transitional cells and the distal by squamous cells. The junction of the two varieties of epithelium is an ideal place for carcinoma to develop (compare lip and anus). The submucosa is well supplied with vessels and lymphatics, and local and glandular involvement is rapid. The average age in the cases reported was 52, the youngest being 32 and the eldest 77. Nearly all the patients were married and most had children. Chronic irritation as a causal factor is discussed, but this is often discovered in patients who have not a tumour and is absent in patients who have a tumour. The urethra is rarely involved in cases of cancer of the kidney, ureter or bladder, so that carcinogenetic factors in the urine are not a cause. He thinks it is rare for a tumour of the bladder to extend to the urethra. [This is not the opinion of many surgeons in this country who see large numbers of bladder growths.]

The symptoms are dysuria, haematuria and chronic retention leading up to acute retention. The diagnosis is made by palpation, endoscopy after dilatation and biopsy. The importance of a positive biopsy is stressed as confusion is liable to arise between malignant growth and polypoid masses. A great majority of the growths are squamous-celled, although adeno-carcinoma has been described and two cases of melanoma have been observed.

J. H. Carver

390. **Urethral Diverticulum.**
By L. R. WHARTON and R. W. TE LINDE. *Obstet. Gynec.*, 7, 503–509. May 1956. 6 figs. 1 table. 7 refs.

This is a study of 66 cases of urethral diverticulum treated at the Johns Hopkins Hospital. Some were lined with epithelium whilst others may represent abscesses. Dysuria occurred in 44 cases, frequency in 27 and urgency in 14. Twenty-six complained of "chronic cystitis". Local pain was noticed by 24 patients. Eleven had noted a vaginal mass, haematuria, stress incontinence and/or dyspareunia. Fifteen had noticed pus coming from the urethra. Three had suffered from acute retention and 3 were febrile. In 4 the condition was discovered on routine examination. The symptoms were generally of long duration.

A suburethral mass was generally visible and palpable, but its position was variable. Pressure on the mass usually produced pus from the meatus. In 42 of the cases a communication between urethra and diverticulum was demonstrated by cystoscopy, but in 8 no orifice could be seen.

Treatment is excision with the necessary plastic repair of the urethra. After excising the whole sac the opening into the urethra is closed. In some cases the opening may be multiple. Some diverticula contain calculi. In rare cases it is necessary to divert the urine through a temporary vesicovaginal fistula which closes spontaneously after the catheter is removed at the end of 2 weeks.

Fifty-eight of the cases treated were followed up. In 42 there were no sequelae. Five had recurrent urinary infections. In 3 cases stricture of the urethra developed, but these were easily treated.

J. G. Dumoulin

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